International Journal of Multidisciplinary Research and Development

Volume: 2, Issue: 7, 560-566
July 2015
www.allsubjectjournal.com
e-ISSN: 2349-4182
p-ISSN: 2349-5979
Impact Factor: 3.762

Priyanka Singh
(Research Scholar),
Department Of Energy and Environmental Sciences Chaudhary Devi Lal University, Sirsa-125055, Haryana. (INDIA)

Rani Devi
Assistant Professor,
Department of Energy and Environmental Sciences Chaudhary Devi Lal University, Sirsa-125055, Haryana. (INDIA)

Hooda R.S.
Chief Scientist (HARSAC-CCS, HAU-Campus) 125004.

Correspondence:
Priyanka Singh
(Research Scholar),
Department Of Energy and Environmental Sciences Chaudhary Devi Lal University, Sirsa-125055, Haryana. (INDIA)

Impact of soil desurfacing on the physico-chemical properties of the soil of the study area in Haryana

Priyanka Singh, Rani Devi, Hooda R.S.

Abstract
The study was carried out to assess the impact of soil desurfacing on some important physical and chemical properties of soil. Soil physic-chemical properties like texture, bulk density, hydraulic conductivity, organic carbon, phosphorus, and potassium content invariably deteriorated significantly in desurfaced soil of the study area. Bulk density increased by 14.37 % (from 1.43-1.67 Mgm^{-3}) and hydraulic conductivity decreased by 51.43 % (from 0.70-0.34 cmh^{-1}) affecting water transmission adversely in desurfaced soil as compared to normal soil. Organic carbon stock decreased by 47.43 % (from 8.58-4.51 $Mgha^{-1}$), Phosphorus (P) content decreased by 33.08 % (10.46-7.0 $kgha^{-1}$) and Potassium (K) content decreased by 44.76 % (from 315.7-174.4 $kgha^{-1}$) in desurfaced soils as compared to normal soil of study area. The evaluation and delineation of desurfaced soil in the study area was done with the help of fusion of geographical information system (GIS) and remote sensing technique, integrating with field observations and laboratory analysis data. Study area falling in national capital region (NCR) is prone to soil desurfacing due to brick kiln activities because of ongoing infrastructural development in the study area.

Keywords: *Soil desurfacing, Physic-chemical properties, Remote sensing, GIS, NCR.*

1. Introduction

Land degradation, defined as the loss or the reduction of the potential utility or productivity of the land, Lal, (1994) [8], is a major environmental problem in arid and semi-arid areas. The environmental global problem of land degradation, which seriously harms human existence and development, includes soil erosion, desertification, salinization or alkalization, soil desurfacing, soil fertility depletion and productivity losses, soil structure degradation and pollution caused by wind, water and other factors like human interventions. When human started the fight for survival and existence and took step forward that was the experience since the beginning of agricultural practices when the first permanent settlements were built along the riverbanks of Asia and Africa, Felipe, *et al*., (2006) [4].

Damage caused by desurfacing, may be determined by soil profile constraints, nature of soil and its position in the landscape orientation. Use of soil desurfacing to simulate soil erosion in several earlier studies and considerable information has been generated abroad on desurfaced soil, Salder, (1984) [13], Gollany, *et al*., (1992) [6]. Although desurfacing is similar to soil erosion when topsoil is lost naturally but in both situations soil loss is eminent. In desurfacing, soil is lost abruptly, whereas, erosion is a gradual process causing loss of soil in due course of time. Desurfacing exhibits immediate adverse impacts on the soil health and productivity, which is a matter of serious concern and needs immediate attention, particularly, for an agrarian state like Haryana (India), where agriculture is the main livelihood of more than 60 % of the population.

In addition to harm to human health, WHO, (2000) [18], other environmental costs of desurfacing due to brick kilns are reduction in soil fertility, drying the groundwater sources, environmental pollution, and increases atmospheric carbon load. Any damage to the fertile land may lead to devastating consequences in terms of decreased food grain production and economic imbalances at national level. The Haryana state, which has a total geographical area of 44212 Sq.km, has a wasteland of 2347.05 Sq.km (ISRO, department of space, Atlas of India, 2006). Conversion of fertile land into wasteland by way of desurfacing is taking place in national capital region (NCR) at a faster pace than expected due to increasing demand for construction material for the accomplishment of various housing and other construction projects. The construction and building activities being unavoidable in the sense that lot of precious fertile agriculture land is converted into wasteland due to desurfacing of soil by brick kiln industries. Restoration and methods of amelioration of desurfaced soil are of serious concern under such circumstances to save further damage to soil health, productivity, and fertility of soil. To evaluate actual damage to the soil health, it is important to understand productivity aspect carefully. Soil productivity is the capacity of the soil to produce crop under specified set of management practices, Soil Survey Staff, (1951) [14]. Sustaining the productivity of the soil has been a worldwide major concern and utmost important priorities, Soil and Water Resource, Larson, *et al*., (1981) [9].

Soil degradation adversely affects composition of fertile topsoil and changes soil properties whether physical or chemical. Any imbalance to the composition orientation may lead to poor soil health creating unfavourable environment in the rhizospheric root zone, affecting plant growth adversely. Desurfacing takes away along with valuable essential plant nutrients and leaving behind the soil deprived of fertility value. Fertility signifies inherent capacity of soil to provide nutrients to plants in adequate amount and proper proportions. Due to desurfacing, essential nutrient stock of topsoil depleted, rendering poor fertility status to the soil.

2. Problem Statement

Removal of topsoil for making bricks has become a common phenomenon, especially in fast growing rural and urban areas of the country like India. India produces 200 billion clay bricks every year, exploiting 675 million tons soil, equivalent to 250 km² (25101.21 ha) per year.

Population pressure especially in national capital region (NCR) of Haryana state has grown enormously in recent decades owing to up surging economy of the country. The requirement for food, water, fuel, raw materials, and other natural resources have grown accordingly, exceeding the carrying capacity of the land in most cases. Demand driven temptation for entering in brick kiln activity, resulting into enormous emergence of desurfaced soils, which is an unsustainable process and harming soil fertility and productivity in an unprecedented way.

3. Specific Objectives

3.1. Objectives that are more specific can be defined as

1. To study physico-chemical properties of normal and desurfaced soils of the area highly prone to brick kiln activities, especially in National Capital Region (NCR) of Haryana state (India)
2. To study the extent of decrease of soil organic carbon, phosphorus, potassium and effect of soil desurfacing on pH, EC, Soil fractions, Bulk density, and Hydraulic conductivity of soil in comparison to normal soil

4. Materials and Methods

4.1 Study Site Description

The study area (Jhajjar District) lies in 29º21′30″ to 29º51′30″to North Latitude, 76º16′30″ to 76º58′45″ East Longitude in the National Capital Region (NCR) of Haryana state (India). Total geographical area of the study area is 1834 km^2. Cultivable area is 1635 km^2.

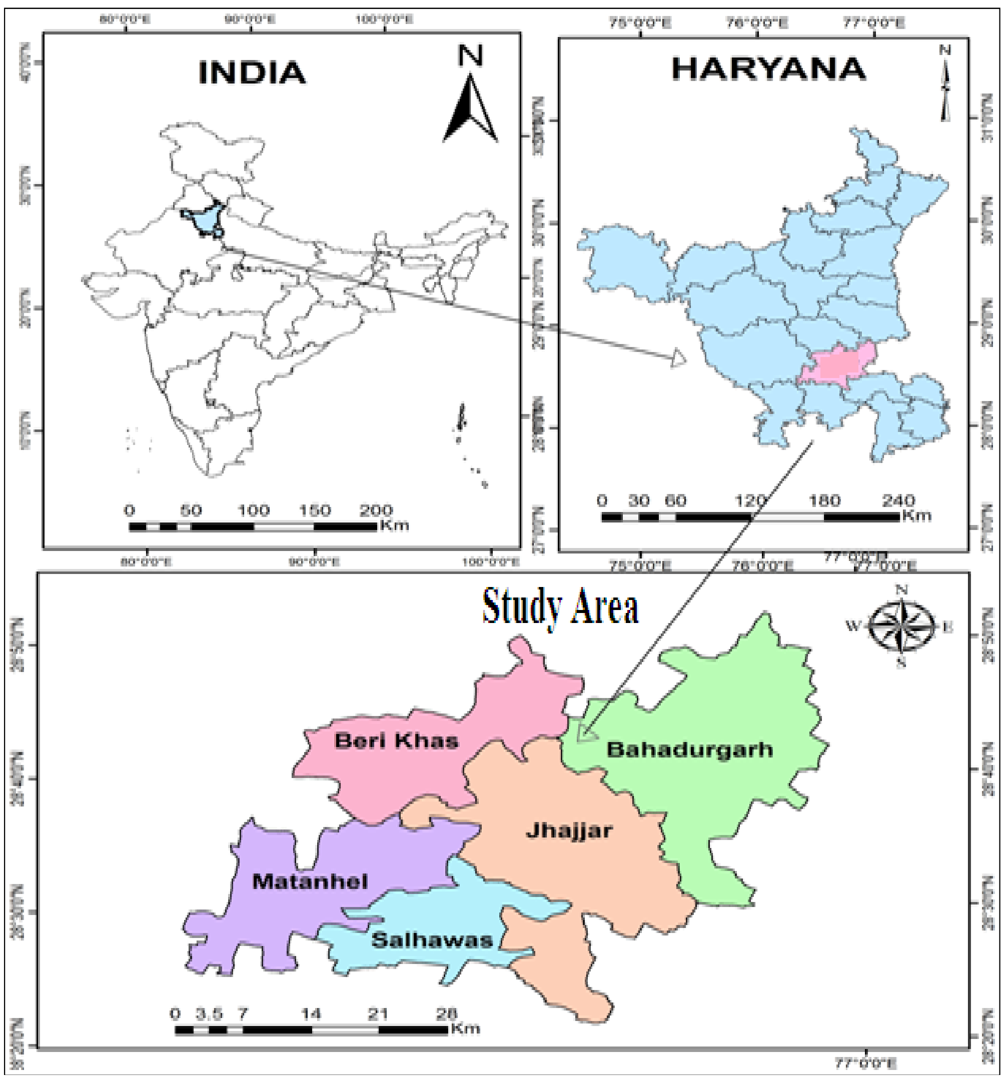

Fig 4.1: Location of study area (Jhajjar District)

Uncultivable land is 24 km^2. Canal irrigated land is 4100 km^2 and tube well irrigated land is 798 km^2. Cropping intensity is 140 % and deep ground water is mostly saline, only shallow water near water bodies, canals, and streams is fresh.

The study area has been divided into five community development blocks (Zones):

1. Jhajjar 2.Bahadurgarh 3.Beri Khas 4.Matanhail 5.Sahalawas

4.1.1 Study Area in Survey of India (Soi) Topographical Sheet

The study area falls in the survey of India (SOI) topographical sheet No. 53D/6, 53D/7, 53D/9, 53D/10, 53 D/11, 53D/13, 53D/14, 53D/15, (Fig. 4.2). Map-Scale 1:25000

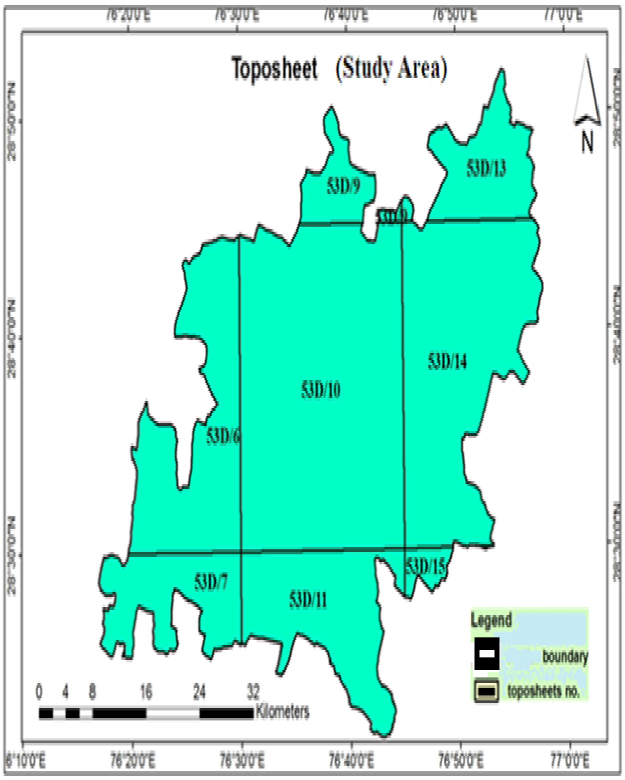

Fig 4.2: Map of topographical Sheet Mosaic of study area (Jhajjar District)

4.1.2 Climate of Study Area

Sub-tropical, semi-arid, continental and monsoon type, main rainy season resumes from July to September driven by southwest monsoons. Average annual rainfall (1987-2005, Climate Atlas, CCS- HAU) was recorded 592 mm. Weather in May and June has been recorded hottest and dry, maximum temperature approaches to 45 ºC in summer and minimum as low as 3- 4ºC in winter nights. Sandy dust cyclones are common in summer season.

4.1.3 Soils of the Study Area

Soil is mostly sandy-to-sandy loam, water infiltration rate is better and even it is easier to manage brackish waters for growing various salt tolerant and semi tolerant crops like wheat and barley crops. Land is not completely flat and plain. There are sand dunes in southwestern part. Mostly soils are sandy to sandy loam, concretion of calcium carbonate at lower depths are common, these concretions hinder the uptake of macro and micronutrients, which are very important essential nutrients for plant growth.

4.1.4 Desurfaced Area and Number of Brick Kilns in Study Area

Desurfaced area and number of brick kilns in the year 2007 and 2012 were determined using remote sensing digitized data (Fig. 4.3) by the author Singh et.al (2014) [15]

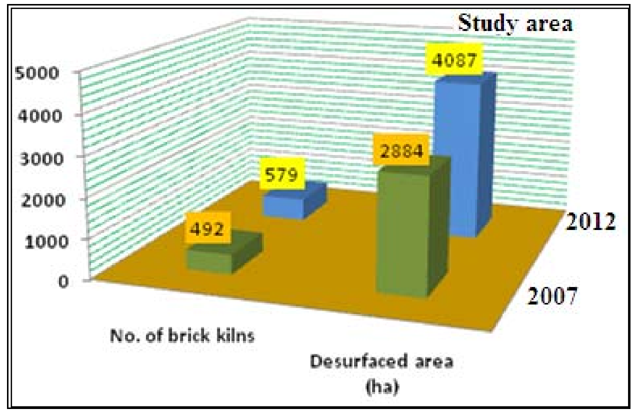

Fig 4.3: Desurfaced area (ha)

4.1.5 Digitizatation of Desurfaced Area in 2012 (Fig. 4.4)

This digitized data has been taken from already published paper by the author Singh et.al (2014) [15].

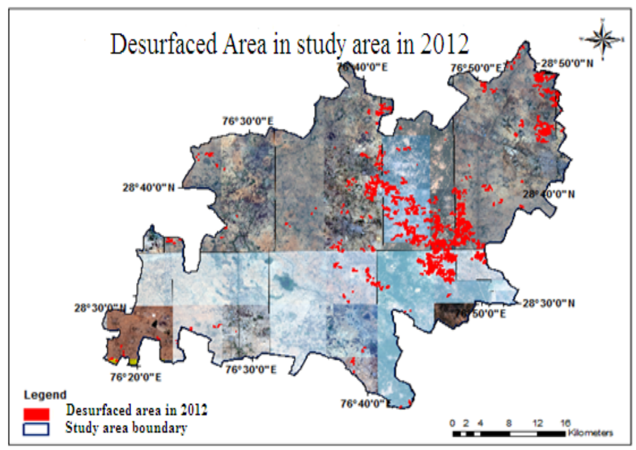

Fig 4.4: Digitizatation of desurfaced area

4.1.6 Gps Location of Sampling Site (Table 4.1)

Table 4.1: GPS location of study area (Zone wise)

S. No.	Location Blockwise or Zonewise	Latitude	Longitude
1	Jhajjar	N 28°40'14.232"	E 6°41'30.948"
2	Beri Khas	N 28°47'5.1"	E 76°41'3.948"
3	Bahadurgarh	N 28°41'26.772"	E 6°41'13.922"
4	Matanhail	N 28°26'17.412"	E 6°16'34.788"
5	Salhawas	N 28°44'27.6"	E 6°41'37.788"

4.2 Methodology

4.2.1 Soil Sampling

Randomized soil sampling was performed in each block as unit of Jhajjar districts, which is the study area earmarked for the present research work. Soil samples (0-15 cm) collected in polyethylene bags using spade / tube auger by adopting standard collection method. Proper tagging and all information like addresses, name of the site, soil surface like normal soil, desurfaced soil, GPS location, *etc*. were recorded and kept inside the bag. For micronutrient analysis, all stainless steel tools were used to avoid Fe contamination.

4.2.2 Physical / Mechanical Analysis

a. *Mechanical composition* of soil samples was determined using international pipette method (Piper, 1950) [11]
b. *Bulk Density* was determined using method given by Blake & Hartge (1986) [1]
c. *Hydraulic Conductivity* was determined using method given by Richards (1954) [12]

4.2.3 Chemical Analysis Methods

I. *Soil pH:* Soil pH was determined in 1:2 soil: water suspension at room temperature with pH meter having glass electrode.
II. *Electrical Conductivity*: The EC of soil samples was determined in 1:2 soil: water suspension with a conductivity bridge at 25 ºC (Richards, 1954) [12].
III. *Organic Carbon*: Organic carbon was determined using Walkley & Black (1934) [17] method and Organic matter by multiplying with 1.724, Van Bemmelen factor.
IV. *Available Phosphorus:* Available phosphorus determined using method given by Olsen *et al*. (1954) [10] extracting with 0.5 N $NaHCO_3$ (pH 8.5).
V. *Available Potassium:* Available potassium was determined by flame photometer extracting with N Ammonium acetate, Richards, (1954) [12].

4.2.4 Statistical Analysis

Statistical analysis of data performed using online Statistical Analysis Tools-OPstat, web site *http://hau.ernet.in/opstat/* and applied for various observations using randomized soil sampling technique and effects compared using least significant differences ($LSD_{0.05 \text{ and} 0.01}$), Standard deviation, and Mean values.

5. Results and Discussion

5.1 Physical Properties

Table 4.2 Effect of desurfacing on some physical properties of soil of selected sites (Block wise) of Jhajjar District

Site location Block wise	Textural Class		Bulk Density (Mg m^{-3})		Hydraulic Conductivity (cm h^{-1})	
	N	D	N	D	N	D
Jhajjar	SL	L	1.46	1.68	0.78	0.40
BeriKhas	SL	L	1.51	1.72	0.71	0.35
Bahadurgarh	SL	L	1.39	1.67	0.58	0.31
Matanhail	SL	L	1.43	1.62	0.71	0.32
Sahlawas	SL	L	1.38	1.65	0.70	0.34
Mean	SL	L	1.32	1.67	0.70	0.34

SL = Sandy loam, L=Loam, N= Normal Soil, D= Desurfaced Soil

5.1.1 Soil Fractions

Sand content found higher in normal soil (73.96 %) as compared to desurfaced soil (64.95 %) and silt and clay content increased from 14.92 - 17.57 % and from 11.12 - 17.48 % respectively in desurfaced soils of study area (Fig. 5.1).

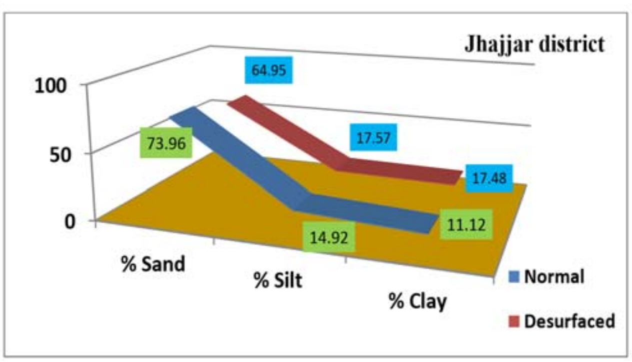

Fig 5.1: Different fractions in normal and desurfaced soil of study area

5.1.2 Bulk Density

The bulk density in normal soil ranged between 1.38-1.51 Mg m^{-3} (Mean=1.43 Mg m^{-3}) and in desurfaced soil between 1.62-1.72 (Mean=1.67) Mg m^{-3}. Bulk density of desurfaced soil found higher as compared to normal topsoil (Table 5.1.Fig. 5.2). Increase was of the order of 13.60 % in desurfaced soil as compared to normal soil. Higher bulk density in desurfaced soil attributed to decrease in organic matter content due to topsoil removal. Use of heavy machinery for tillage in farm practices and other farm activities mainly contributing to compaction of lower horizon, resulting into high bulk density of the profile. Another reason of high bulk density values attributed to migration of finer soil particles, like silt, clay, and $CaCo_3$ to lower horizon. These results also correspond with the results of Indorante, *et al.*, (1981), Gollany, *et al.*, (1992) [6].

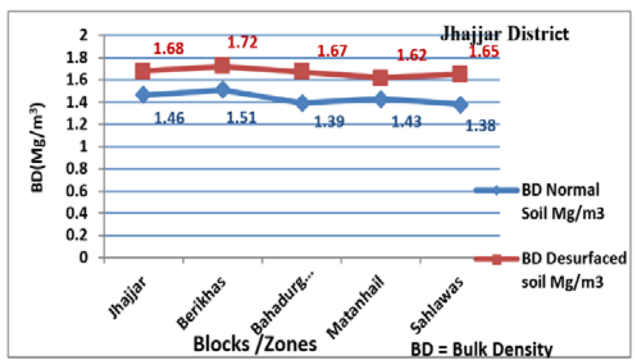

Fig 5.2: Bulk Density (Mg m^{-3}) of Normal and Desurfaced soils

5.1.3 Hydraulic Conductivity

Hydraulic conductivity of desurfaced soil decreased from 0.70 to 0.34 cmh^{-1} in study area (Fig. 5.2). There is 51.43 % decrease in hydaulic conductivity in these soils, which is statistically highly significant. It is attributed to the fact that topsoil removal alters the resistance of surface aggregates of dispersion from surface flow providing rain drops energy where stability of aggregates for desurfaced soil is lower than normal soil, Gollany, *et al.*, (1991) [5],. Unstable aggregates easily be broken down and can be transported through suspension, which can lead to crust formation and inhibits air and water entry into the soil profile. High bulk density and low hydraulic conductivity of these soils will decrease the availability of P and K as evidenced in this study. When topsoil is lost due to desurfacing, P and K automatically lost in the process leaving behind soil deprived of these essential nutrients as illustrated (Fig 5.3). Brookes, *et al.*, (1982) [3] observed lesser microbial biomass and phosphorus in sub soil as compared to normal topsoil.

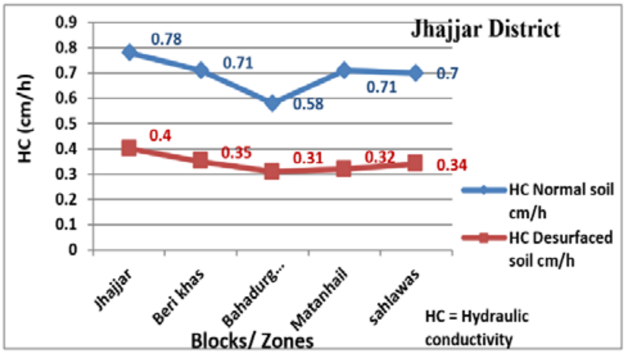

Fig 5.3: Hydraulic Conductivity (cm h^{-1}) of normal and desurfaced soil

5.2 Chemical Properties of Soil

Table 4.3: Effect of desurfacing on different chemical properties of soil of selected sites of Jhajjar districts

Blocks	pH (1:2)		EC(dS m^{-1}) (1:2)		O.C (%)		P (Kg ha^{-1})		K (Kg ha^{-1})	
L-S	N	D	N	D	N	D	N	D	N	D
Jhajjar	8.0	8.5	0.29	0.24	0.42	0.20	10.92	5.68	224.8	125.6
BeriKhas	8.2	8.7	0.76	0.30	0.38	0.16	10.48	8.73	317.4	208.3
Bahadurgarh	8.1	8.6	0.87	0.62	0.39	0.15	11.79	8.30	398.3	214.1
Matanhail	8.0	8.6	0.39	0.21	0.40	0.21	9.61	6.11	331.4	175.2
Sahlawas	8.0	8.5	0.51	0.39	0.40	0.19	8.30	4.80	322.3	148.8
Mean	8.1	8.6	0.56	0.35	0.40	0.18	10.48	6.72	315.7	174.4

N = Normal Soil, D = Desurfaced Soil, L-S = Land Surface

T-test for Jhajjar District soil

Character	Group	Assumptions	t	d.f.	Probability
BD	1&2	Equal Variances Assumed	**13.7	18	0
		Unequal Variances Assumed	13.7	17.04	0
HC	1&2	Equal Variances Assumed	**12.84	18	0
		Unequal Variances Assumed	12.84	12.94	0
pH	1&2	Equal Variances Assumed	*3.08	18	0.0065
		Unequal Variances Assumed	3.08	17.55	0.0066
EC	1&2	Equal Variances Assumed	NS 0.67	18	0.5141
		Unequal Variances Assumed	0.67	16.76	0.5148
OC	1&2	Equal Variances Assumed	**9.63	18	0
		Unequal Variances Assumed	9.63	16.77	0
P	1&2	Equal Variances Assumed	**5.34	18	0
		Unequal Variances Assumed	5.34	17.83	0
K	1&2	Equal Variances Assumed	**6.65	18	0
		Unequal Variances Assumed	6.65	13.88	0

* = Significant at LSD $_{0.05}$, ** = Significant at LSD $_{0.01}$, NS = Non-Significant

5.2.1 Ph of Soil

Mostly soils under study are alkaline in nature, pH values ranging between 8.0-8.4 in normal soil and 8.1-8.5 in desurfaced soil of study area. The pH of normal and desurfced soil ranges from 8.1-8.5 (Fig. 5.4), significant at LSD $_{0.05}$. Slightly higher pH observed in desurfaced soil as compared to normal soil, which may be the cause of less availability of Micronutrients causing deficiency of these essential nutrients in desurfaced soil

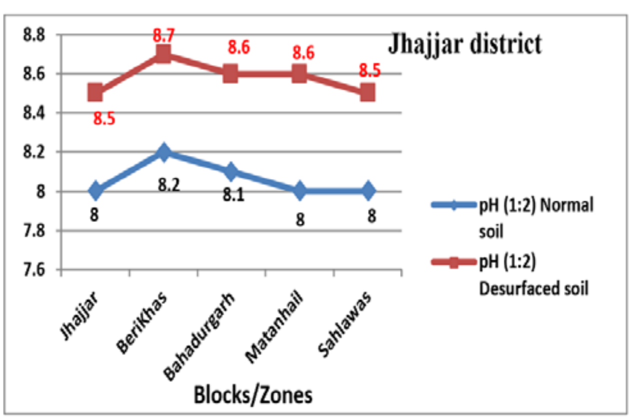

Fig 5.4: pH of normal and desurfaced soil of study area

5.2.2 Electrical Conductivity

Higher values of EC observed in case of normal soils as compared to desurfaced soils (Fig. 5.5), statistically NS. This may be associated with the fact that in surface soil, salt accumulated due to capillary rise in presence of high temperature and low rainfall, causing high EC values to surface soil. Downward movement of salt is also very slow due to less rainfall.

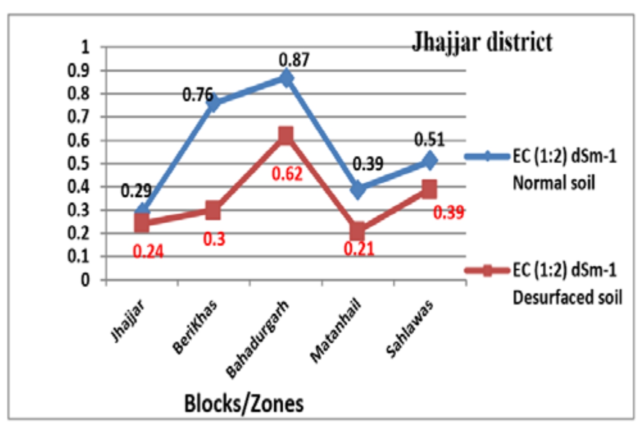

Fig 5.5: Electrical conductivity of normal and desurfaced soil of study area

5.2.3 Organic Carbon

Soil organic matter has profound effects on soil functions and various properties whether physical or chemical in nature. This ever-changing soil component exerts a dominant influence on many soil physical, chemical, and biological properties, especially in the surface horizons. Soil organic matter provides soil, cation exchange capacity, and water-holding capacity. Certain components of soil organic matter are largely responsible for the formation and stabilization of soil aggregates. Soil organic matter also contains large quantities of plant nutrients and acts as a slow-release nutrient storehouse. Organic matter also provides energy and bodybuilding constituents for microorganisms, which are responsible for various processes in soil system, bearing growth-stimulating effects on plants. Soil organic carbon is the index of soil organic matter in the soil.

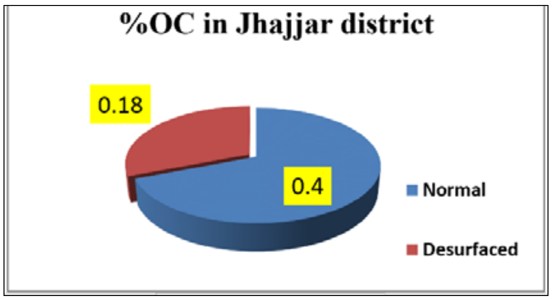

Fig 5.6: Organic carbon content in normal and desurfaced soil of study area

In the soil of study area, organic carbon content ranged between 0.35-0.49 % (Mean=0.40 %) in normal soil and 0.15-0.20 % (Mean=0.18 %) in desurfaced soil. Reduction in organic carbon stock (Fig. 5.7) in desurfaced soil was of the order of 47.43 %, which is statistically highly significant in these soils at $LSD_{0.05}$.

This is attributed to the fact that in case of desurfaced soil, topsoil is completely lost in desurfacing process exposing lower horizon, which is inherently poor in organic matter content. Main seat of organic matter lies in topsoil (surface soil); continuous incorporation of crop residues in topsoil in presence of optimum moisture and temperature, soil microorganisms play important role in the decomposition process and help hastening and building organic matter level in topsoil, which is important for sustaining soil fertility, Tressen, *et al.*, (1994) [16]. Because of desurfacing, this reserve organic matter is lost in the process, leaving behind completely deprived of the organic matter.

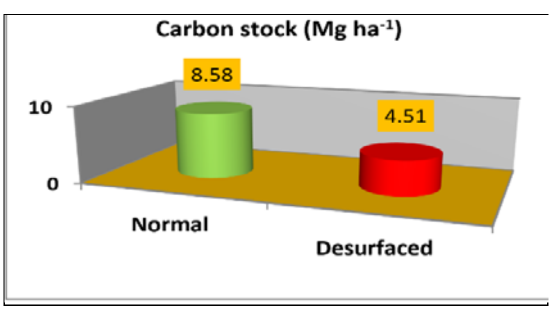

Fig 5.7: Organic carbon stock (Mg ha^{-1}) in normal and desurfaced soil

Organic matter contains 58 % labile organic carbon. Carbon stock observed higher level in normal soils of the study area (8.58 Mgha^{-1}) as compared to desurfaced soils as is evidenced in (Fig. 5.6), Gollany, *et al.*, (1992) [6], and Zhang and Fang, (2007) [19] observed similar results in their findings corroborating present finding.

Organic Carbon Stock (Mg ha^{-1}) = O.C (%) x B.D (Mg m^{-3}) x Soil Depth (cm)

5.2.4 Available Phosphorus

The process of land desurfacing significantly affects the availability of phosphorus in soil. In normal soil of study area, the range of P is 8.30 to 11.79 kg ha^{-1} (Mean=10.46 kg ha^{-1}) and in desurfaced soil is 4.80 to 8.73 kg ha^{-1}(Mean=6.92 kg ha^{-1}). Net decline amounts to about 33.08 % (Fig. 5.7), which is statistically highly significant. Phosphorus being one of the major essential nutrients may affect the productivity of soil and influencing overall crop production.

In Jhajjar district, in normal soil the range of P is 8.30 to 11.79 (Mean=10.46) kg ha^{-1} and in desurfaced soil is 4.90 to 8.73 kg ha^{-1}(Mean=6.72). Net decline amounts to about 33.08 % (Fig. 5.8), which is statistically highly significant at $LSD_{0.05}$.

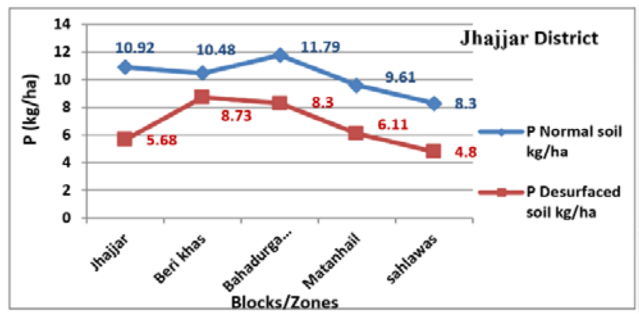

Fig 5.8: Phosphorus in normal and desurfaced soils of study area

Among the nutrient elements, phosphorus is second only to nitrogen in its impact on the productivity and health of terrestrial and aquatic ecosystem. The total quantity of phosphorus in most native soils is low, with most of what is present in the forms quite unavailable to plants. Neither plants nor animals can survive without phosphorus. It is an essential component of the organic compound like adenosine triphosphate (ATP), which is the *energy currency* that drives most of the biochemical processes. Phosphorus is also an essential component of deoxyribonucleic acid (DNA), the seat of genetic inheritance.

5.2.5 Available (Exchangeable) Potassium

Exchangeable potassium in normal soil of the study area (Fig. 5.9) ranges between 224.79 to 398.34 kgha^{-1} and in desurfaced soil between 125.62 to 214.05 kgha^{-1}. Decline in exchangeable K level due to desurfacing is about 44.76 % in soils of study area, which is statistically highly significant at $LSD_{0.05}$., Brookes *et al.*, (1982) [3] attained similar results in their findings.

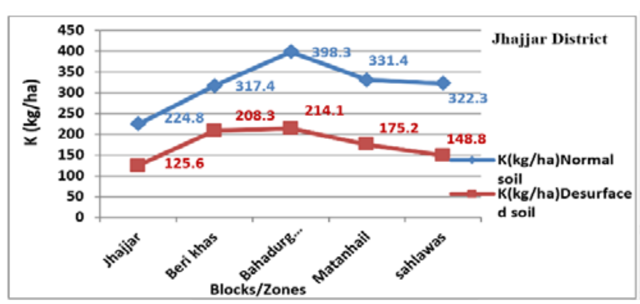

Fig 5.9: Potassium (kg ha^{-1}) in normal and desurfaced soil

Exchangeable potassium followed similar trend as in case of organic carbon in desurfaced soil, Bramble-Brodhal, *et al.*, (1985) [2]. Reason for this diminishing trend of K in desurfaced soil may be associated with the decreased organic matter in sub soil giving rise to poor biological activities due to unfavourable environment. Another reason attributed to no prevalence of sufficient weathering process and not releasing ample K from potassium rich mineral like illite type, which is taking place in ample amount in surface soil, but unfortunately surface soil is lost due to soil desurfacing, depriving of K content.

The original sources of potassium in soil are the primary minerals, such as biotite, muscovite, and feldspar and mica and held between 2:1 type crystal layers (lattice), which become available to plants only after going through weathering processes. After weathering of primary minerals, there is formation of secondary minerals like silicate clays (2:1 and 3:1 type). Illite type (2:1) of secondary minerals is reach source of potassium, which are much prevalent in Haryana soils. However, weathered part of potassium in surface layer of soil is lost due to soil desurfacing leaving behind k-depleted soil.

6. Conclusion

The land degradation process is generally divided into three classes: (1) physical degradation, (2) biological degradation, and (3) chemical degradation. Present study has proved the prevalence of degradation of two important soil properties, physical and chemical, which have invariably deteriorated due to soil desurfacing. All the major nutrients needed for plant growth have decreased significantly in desurfaced soil of the study area as compared to normal soil. Organic matter, which is considered the reservoir of all nutrients, has depleted more than fifty percent in desurfaced soil. Loss of organic matter has given rise to increase in bulk density and decrease of hydraulic conductivity of soil, deteriorating rhizospheric physical environment, restricting root proliferation of plants and also not favourable for micro flora, as a result microorganism mediated processes will be hampered. Due to desurfacing in study area

- Bulk Density (Mg m^{-3}): Increased by 14.37 % in desurfaced soil
- Hydraulic Conductivity (cm h^{-1}): Decreased by 51.43 % in desurfaced soil
- Organic Carbon (%): Decreased by 55 % in desurfaced soil
- Organic Carbon-Stock (Mg ha^{-1}): Decreased by 47.43 % in desurfaced soil
- Phosphorus (kg ha^{-1}): Decreased by 33.08 % in desurfaced soil
- Potassium (kg ha^{-1}): decreased by 44.76 % in desurfaced soil

7. References

1. Blake, G.R., and Hartge, K.H., (1986). *Bulk Density in Methods of Soil Analysis*. Part-I. *Soil. Sci. Soc. Am. J.* Madison, WI, USA. Pp, 163-17.
2. Bramble-Brodhal, M., Fosberg, M.A., Walker, D.L., and Falen, A.L., (1985). Changes in soil Productivity related to changing top soil depth on two Idaho Palaouse soils. P. 18-27 Int. Nat. Symp. *Erosion and soil productivity* ASAE Publ. 8-85. ASAE, St. Joseph. MI
3. Brookes. P.C., Powlson, D.S., and Jenkinson, D.S., (1982). Measurement of microbial Biomass and phosphorus in soil. *Biol. Biochem.* 14, 319-329
4. Felipe, I.P., Dohm, J.M., Baker, V.R., Doggett, T., Davies, A.G., Castano, R., Chien, S., Cichy, B., Greenley, R., Sherwood, R., Tran, D., and Rabideau, G., (2006). Flood detection and monitoring with the autonomous sciencecraft experiment onboard EO-1. *Remote Sensing of Environment* 101: 463-481.
5. Gollany, H.T., Schumacher, T.E., Evenson, P.D; Lindstorm, M.J; and Lemme, G.D., (1991). Aggregate stability of an eroded and desurfaced Typic Agriustoll. *Soil Sci. Soc. Am. J.* 55; 811-816
6. Gollany, H.T., Shcumacher, T.E., Evenson, P.D., Lindstorm, M.J., and Lemme, G.D., (1992). Top soil depth and desurfacing effects on properties and productivity of a Typic Agriustoll. *Soil Sci. Soc. Am.J.* 56; 220-225
7. Indorante, S.J., Jansen, I.J., and Boast, C.W., (1981), Surface mining and reclamation. Initial changes in soil character. *J. Soil Water cons.* 36: 347-350
8. Lal, R., (1994). Soil Erosion Research Method. Soil and WaterConservation Society. St. Lucie Press, Delray Beach, FL
9. Larson, W.E; Walish, L.M; Stewart, B.A., and Boelter, D.H., (1981). Soil and Water resource. *Soil Sci. Soc. Am.J.* Salder, (1984). Madison, Wise
10. Olsen, S.R., Cole, C.V., Watnabe, F.S.,and Dean, L.A., (1954). Estimation of available phosphorus in soils by extraction with sodium biocarbonate. USDA, Cire. 939. U.S. Government Printing office, Washington, D.C
11. Piper,C.S., (1950). *Soil and Plant Analysis*, The University of Adelaide Press, Adelaide, Austrailia, 368 p
12. Richards, L.A., (1954). Diagnosis and Improvement of saline and alkali soils. Agricultural Handbook No.60, USDA
13. Salder, J.M., (1984). Effect of top soil loss and intensive cropping on soil properties related to crop production potential of podozolic Grey Luvisol. *Can. J. Soil Sci.* 64: 533-543
14. Soil Survey Staff, (1951). Soil Survey manual. Agr. Handbook. No. 18.U.S. Dept. Agr, Washington, D.C
15. Singh, P., Devi, R., Hooda, R.S. and Grewal, M.S., (2014). Map and Identify Desurfaced Soils in Rohtak and Jhajjar District in Last Five Years Using RS. International Journal of Emerging Science and Engineering (IJESE), Vol. 2 (4), Feb. 2014, ISSN: 2319-6368.
16. Tressen, H., Cuevas, E., and Chacon, P., (1994). The role of soil organic matter in sustaining soil fertility. *Nature* 371: 783-785
17. Walkley, A., and Black, C.A., (1934). An examination of method for determination of soil organic matter and a proposed modification of the chromic acid titration method, *Soil Science* Vol.37: 29-34
18. WHO, (2000). Guidelines for Air Quality, Geneva: World Health Organization (Retrieved) *http:// www. rshm saglia*. Gov.tr/hki/pdf/ Guidelines for Air Quality pdf
19. Zhang, M.K., and Fang, L.P., (2007). Effect of tillage, fertilizes and green manure cropping On soil quality at an abandoned brick kiln site *Soil and Tillage Research* 93, 87-93.