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The Effect of Spent Lubricant Oil on Physico-Chemical Properties of Soil and Waterin Cocoa Yam (Colocasiaesculentus L.) Farmland in Abakaliki Ebonyi State Nigeria

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ABSTRACT: The effect of spent lubricant oil on the physico-chemical parametersof soil properties and water quality in an ultisol in Abakaliki, South-Eastern Nigeria for 2016, 2017 and 2018 cropping seasons. A land area of 64 x 64m was used for the experiment arranged in Randomized Complete Block Design (RCBD). Four treatments vis control (C) 2.5 litres of spent lubricant oil (Aa) 5.0 litres spent lubricant oil (Bb) and 7.5 litres of spent lubricant oil (Cc) were used for the study, the treatments were replicated five times and cocoyam (colocasiaesculeatusL. variety xanthosomespp) was used as a test crop. The data collected were subjected to analyses of variance (ANOVA) for RCBD and means separation carried out using fishers least significant diference (FLSD). Results of the study showed that application of spent lubricant oil significantly ($P<0.05$) increased soil bulk density relative to the control. Results also showed significantly lower total porosity, hydraulic conductivity, and aggregate stability in control compared to spent oil contaminated soil. Soil chemical properties of exchangeable bases (Ca, Mg, Na, K, available P, organic carbon pH and Total N were higher in spent oil contaminated plots compared to control. The study recommended that spent lubricant oil should be avoided in soil and water as it affects their physico-chemical properties and limit higher and sustainable productivity in crops.

Key word: Abakaliki, spent lubricant oil, soil property,bulk density, physico-chemical Cocoa yam, water quality,exchangeable bases

I. INTRODUCTION

Nigeria is a main crude oil exporter in addition to a critical agricultural country inside the West African sub-area. Financial benefits derivable from oil have no doubt left terrible impacts at the surroundings outcomes of spent oil infection physio-chemical homes of soils (Amadi, 2002). The fast growing call for and supply of crude oil and new chemical substances by the industrialized society of the 21st century has located higher stress at the natural environment at large. Quantities of diverse chemical substances and contaminants enter into the soil through anthropogenic activities that positioned soil susceptible to contamination. Furthermore, upgrades in private emoluments due to growth in minimum salary have brought about corresponding boom in ownership of automobiles in the Nigeria. This now necessitate establishment of greater automobile workshops with the poor outcomes of soil infection with spent lubricant oil. This situation is a not unusual phenomenon round car offerings seeing that rainfall or walking water can purpose speed of soil infection of farm lands. By the way, food plants are grown around areas in near proximity to auto-mechanic workshop or automobile service centers. Abioyeet al., 2012 mentioned that the environment played a key position inside the final fate and shipping of contaminants. In step with them, the unique fate of contaminants, following their launch into the environment, depends on their chemical shape, that's exceedingly variable, abiotic factors in the receiving surroundings (e.g Organic carbon, pH, surface water), and interplay with the biotic surroundings. The redox capacity determines the oxidative state of the metals. Interaction with biotic

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environment to a great volume determines destiny of contaminants in soil. Bio transformation refers back to the alteration of compound because of the have an effect on of dwelling organisms. It's miles the maximum regularly occurring manner causing the spoil down of organic compounds within the subsurface's (Doe, 1991). Doe (1991) mentioned that bio degradation was a greater specific time period used to describe the biologically mediated alternate of a chemical into easier merchandise, although, the less complicated "daughter" products may be as toxic as or greater toxic than the unique compound. For example, anaerobic bio transformation of tetra-and trichloroethylene yields similarly poisonous or more staying power dichloroethylene and vinyl-chloride (Agboret al., 2014).

Oil spent happening in clean water bodies are much less publicized and after greater destructed to the surroundings. Clean water our bodies are fantastically sensitive to oil spent and are critical to human fitness and the surroundings. All kinds of clean water organisms are liable to the deadly effects of spent oil which include mammals, aquatic birds, fish, bugs micro-organisms, and plants (Cimmyst, 1993). The effect of spent oil on clean water micro-organism, invertebrates and algae tends to transport up the meals chain and have an effect on different species. The effect of spent oil in water our bodies varies consistent with the rate of water go with the flow and the habitat's specific function spent oil effect flowing water much less significantly than status water because the cutting-edge offers a natural clearing mechanism. Although the effect of spent oil on river habitat can be less intense or final for a shorter quantity of time than standing water, the sensitivity of the river and movement habitat's is much like that of status water, with a few special functions (Coelliet al., 1998).

1. 1 Aim

The primary objective of the studies become to determine the impact of spent lubricant oil on the physico-chemical soil houses, water quality and yield of cocoa yam (colocasiaesculentus l.) in Abakaliki, South-East Nigeria.

1. 2 Particular Objectives

They includedetermining:

i. The effect of spent lubricant oil on soil houses.
ii. Determine physio-chemical properties of move water (Iyeudelene in Abakaliki) as inspired by using spent lubricant oil.

II. STUDY LOCATION

The Physico-chemical properties of soil and water in Abakaliki in 2016, 2017 and 2018 cropping seasons were evaluate. This research was carried out at the faculty of agriculture and herbal assets control, teaching and studies farm, Ebonyi State University, The site is placed by means of Latitude $06^0$4'N and longitude $08^0$65'E within the derived savannah sector of the southeast agroecological vicinity of Nigeria. The region is characterized by excessive temperatures with minimum mean daily temperature of 27^0c and maximum mean every day temperature of 31^0c for the duration of the 12 months. Humidity is high (eighty%) with lowest (60%) stages happening during the dry season among December to April, earlier than the rain season begins. The rainfall sample is biomodal (April – July and September – November) with a quick dry spell in august commonly called "august wreck". The overall annual rainfall inside the vicinity tiers from 1500 to 2000 mm, with a median of 1,800 mm. At the onset of rainfall, it's far torrential and violent, sometimes lasting for one to 2 hours (Okonkwo and Ogu, 2002). Geologically, the area is underlain by using sedimentary rocks derived from successive marine deposits of the cretaceous and tertiary durations.

2.1 Land Guidance and Remedy Application

An area of land that measured 64 x 64m was used for the study. The land became demarcated into seedbeds. The plots had been laid out as in Randomized Complete Block Layout (RCBD). The remedies have been as follows: (c) control (no application of oil lubricant) 2.5 litres of spent lubricant oil (aa), 5.0 litres of spent lubricant oil (bb) and 7. 5 litres of spent lubricant oil (dd). The spent lubricant oil had been sourced from the mechanic village in Abakaliki turned into sprayed on the seedbeds at the rates of 2. 5, five.Zero and seven.5 litres. They had been incorporated into the soil at some point of seedbed preparation the usage of conventional hoe. The beds measured 4m with the aid of 4m with 1m intra and inter row spacing among the beds respectively. The beds were allowed to age for 2 weeks after incorporation of treatments before planting the check crop. Cocoyam corm colocasiaesculentus l. Range, sourced from Ebonyi Country Agricultural Development Programme (EBADEP) become planted at 10 seeds in step with seed bed at 5cm intensity and spacing distance of 100cm. There was an application of NPK (15:15:15) fertilizer at on each seedbed Weeks After Planting Emergence (WAPE). The fertilizer become positioned 5cm

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faraway from the cocoyam flowers. Weeds had been removed at three weeks interval up until harvesting in all of the cropping seasons.

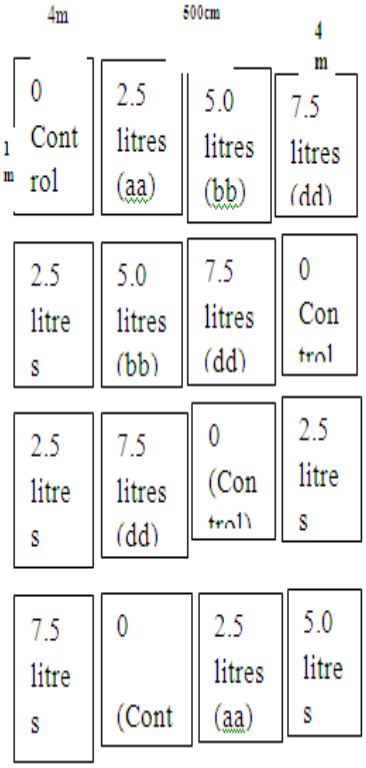

Figure1: Subject Format

2.2 Soil Sample Collection

At the beginning of the experiment auger soil samples had been randomly gathered from eight one of a kind spots at a depth of 0-20cm. The auger samples have been thoroughly combined to shape a composite sample and analysed for initial soil homes. The spent lubricant oil become additionally analyzed for its compositions. On the quit of every cropping season (after) harvest undisturbed center samples had been accrued from each plot and used for dedication of soil bodily homes. At forty five and ninety days after planting (dap) undisturbed middle samples have been taken from all plots and used to decide soil bulk density. Further, auger samples had been gathered from the plots, air dried, sieved and used for willpower of chemical homes.

2.3 Collection of Water Samples

Water samples were gathered from Iyiudelene move nearest to the mechanic village series web sites. These samples had been accumulated in suitable sample boxes in line with the respective parameters to be decided namely: amber bottles for Biological Oxygen Demand (BOD) dedication, small plastics for physico-chemical parameters. All samples were saved into ice-packed coolers and transported inside 6 hours to the laboratory for analyses.

2. 4. Willpower of Physio-Chemical Residences of Soil

2.4.1 Determination of Soil Physical Properties

Soil texture distribution was determined using the middle method

2.4.2 Willpower of Bulk Density and Total Porosity

Bulk density (db) became decided using the center approach. General porosity turned into calculated from the bulk density value with assumed debris density of 2. 65gcm-three the usage of the equation.

Tp = (1 – bd/pd) x one hundred/1 - - - - - (1)

in which tp = overall porosity, bd = bulk density and pd – particle density

2.4.3 Willpower of Hydraulic Conductivity

hydraulic conductivity changed into decided by the regular head approach (Klute and Dinken, 1986) the equation is as follows:

ks = q/at x al/l - - - - - (2)

wherein q is the mean quantity of water cm3 that handed thru cross sectional area of soil in time (seconds) l is the duration of the core (m), a is the pass sectional region of the core (cm^2). H is hydraulic head difference (cm^3) and okay is saturated hydraulic conductivity

ks = mean volume of water performed x hydraulic head trade

pass sectional vicinity of center x time soil pattern period - (3)

2.4.4 Determination of Gravimetric Moisture Content

gravimetric moisture content material was decided according to the technique of (Obasi, 2004). 3.

2.4.5 Determination of Aggregate Balance

Mixture stability became determined with the aid of wet sieving technique

2.5 Determination of Soil Chemical Homes

2.5.1 Willpower of soil ph

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Soil pH in (1:2:5 soil/water ratio) changed into determined using electrode glass pH meter (Tel and Hagarty, 1984).

2.5.2 Willpower of Total Nitrogen (TN)

This turned into determined the use of the micro-kjeldhal distillation method of (Bremner, 1996). The ammonia from the digestion became distilled with 45% Na0H into 2. Five% boric acid solution and decided by means of titrating with zero. 05hcl.

2.5.3 Willpower of to be had Phosphorus

This turned into determined via the bray-2 technique as described by (Web Page et al., 1982). The available phosphorous became examine off from the standard curve obtained from optical density the use of a colorimeter.

2.5.4 Determination of Natural Carbon

This changed into determined the usage of the approach defined through Nelson and Sommers (1982) the share natural depend became calculated by means of mutilplying the value for organic carbon with the aid of the "van bemmeler element" of one,724, which is primarily based on the belief that soil organic be counted (50m) contains fifty eight% (Allison, 1982).

2.5.5 Dedication of Exchangeable Acidity

The titrimetric method using 1nkcl extract of mclean (1982) became used inside the dedication of exchangeable acidity (al3+ and h+).

2.5.6 Willpower of Cation Trade Potential

This became decided by using ammonium acetate (nh4oac) Displacement (Jackson, 1958).

2.5.7 Dedication of Base Saturation

Base saturation (bs) turned into calculated with the aid of dividing general exchangeable based totally (teb) with cation alternate potential price and multiplying with the aid of one hundred. The expression is consequently:

% bs = tebx one hundred--- (4)
cec 1

2.6 Determination of Chemical Properties of Water

(i) pH Determination

Apparatus: fisher brand three hundred ph meter. System: the ph meter was standardized with buffer solutions ph 7 and pH 10 after which it was washed with distilled water, wiped and immersed within the water samples in which it changed into retained for a brief while until the tool beefed prepared. The analyzing for each pattern had been recorded.

(ii) Conductivity dedication: conductivity meter with atc-milwaultee

system: the conductivity meter turned into standardized with 0. 01m kcl solution. The electrode was rinsed with distilled water, wiped and dipped into the water samples and left for some time to acquire a solid analyzing which turned into recorded in micro-siements in step with centimeter (us/cm).

(iii) Overall Dissolved Solid (TDS) Determination

equipment: beaker, oven desiccations, evaporating dish, measuring cylinder, analytical stability. Technique:100ml of water pattern changed into measured into a pre-weighed dry evaporating to dryness at 1030c. The evaporating dish become allowed to cool in a desecrator and weighed once more and the distinction in weighed became recorded (Welcher, 1993).

(iv) Total Suspended Solid (TSS) Willpower

Equipment: beaker, filter out paper, oven, desiccators, measuring cylinder, electrical balance
manner: 100ml of water sample became measured and filter out paper which became allowed to dried in an oven for/hour. The gain in weight turned into recorded (Welcher, 1993).

2.7 Statistics Evaluation

The soil and water facts have been subjected to evaluation of variance (ANOVA) and the method that had been tremendous separated the use of the Fishers Least Considerable Distinction (FLSD), using statistical analysis device (Sas, 1985).

III. 3.0 RESULT

3. 1 Initial Properties of Soil

The particle size distribution evaluation shows that the soil is sandy loan with the pH in (h20) were five. 60 indicating that the soil became acidic in. The share organic count becomes 1. Eighty one and rated low. The percentage general nitrogen (0. 60) became higher than potassium zero. 08. The soil alternate complex turned into dominated by way of calcium and magnesium with values of two. Forty and 1.20 $cmolkg^{-1}$ respectively. The available phosphorus changed into low with value of 26. $10mgkg^{-1}$. The soil exchangeable acidity (ea) turned into 0. Forty eight $cmolkg^{-1}$.The soil cation exchange capability (cec) forty three. 71 cmolkg-1 rated low consistent with.

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Table1: Initial Residences of Soil

Parameters	Gadgets	Values
Sand	gkg^{-1}	560
Clay	gkg^{-1}	200
Silt	gkg^{-1}	240
Textural class (kcl)	Sandy/loam	5.6
Bulk density (BD)	gcm^{3}	1.45
Total porosity (TP)	%	45.67
Hydraulic conductivity (HC)	$cmhr^{-1}$	26.90
Moisture content (MC)	%	18.72
pH (H_20)	-	5.60
Available phosphorus	$mgkg^{-1}$	26.10
Total nitrogen	%	0.60
OC	%	1.05
Ca^{2+}	$cmolkg^{-1}$	2.40
Mg^{2+}	$cmolkg^{-1}$	1.20
K^{+}	$cmolkg^{-1}$	0.08
Na^{+}	$cmolkg^{-1}$	0.21
Exchangeable Acidicity (EA)	$cmolkg^{-1}$	0.48
Effective Cation Exchange Capacity (ECEC)	$cmolkg^{-1}$	7.97
Basic Saturation (BS)	%	89

3.2 Residences of Spent Lubricant Oil

Table 2 showed organic carbon and phosphorus values of forty four. 86, zero.Ninety two% and 14.00 mgkg-1 respectively were discovered.

Table 2: Houses of Spent Lubricant Oil

Parameters	Gadget	Values
N Total Nitrogen	$mgkg^{-1}$	0.60
Organic carbon	%	0.92
Phosphorus	$mgkg^{-1}$	14.00

3. 3 Impact on Soil Physical Houses

3.3.1 Particle Length Distribution

Particle length distribution of soil is shown on table 3. The outcomes indicated that particle length distribution did no longer vary substantially in the soils. Sand changed into the dominant fraction. The excessive content of sand in the soils appears to be associated with the parent substances and climate of the region. Sand content material of the soils in Southeastern vicinity is a function of sand fashioned on unconsolidated coastal plain and sand-stones from 'asu river'. Sandy soil is liable to drought. The textural class consistently remained sandy loam in infected and uncontaminated soils for 2016, 2017 and 2018 cropping seasons. Said that texture changed into "permanent belongings" of soil. Texture has true relationship with nutrient storage, water retention, porosity, particular floor location, soil compatibility and compressibility which affect inherent productiveness of the soil.

Table 3 Impact of spent lubricant oil on particle length distribution of sand, silt and clay

Treatment	2016			2017			2018		
	Sand gkg^{-1}	Silt gkg^{-1}	Clay gkg^{-1}	Sand gkg^{-1}	Silt gkg^{-1}	Clay gkg^{-1}	Sand gkg^{-1}	Silt gkg^{-1}	Clay gkg^{-1}
Control (C)	34.5	35.3	30.2	34.5	34.2	30.2	34.3	35.3	30.4
Aa	35.5	34.3	30.2	35.3	34.5	30.1	35.2	34.4	30.4
Bb	35.3	34.4	30.4	35.3	34.3	30.4	35.4	34.3	30.3
Dd	35.4	34.3	30.3	35.3	34.6	30.2	35.3	34.2	30.5

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FLSD (0.05)	NS	NS	NS	0.4	NS	NS	NS	NS	NS

Where (aa) 2.5 litres, (bb) 5.0 litres (dd) 7.5 litres

3.3.2 Effect of Spent Lubricant Oil on Bulk Density (gcm-3)

Table Four showed that spent lubricant oil appreciably improved (p<0. 05) soil bulk density relative to control in 2016, 2017 and 2018 cropping seasons. In 2016 cropping season observed bulk density (bd) value at 45 days after planting was 1. 50, 1.48, 1.45 and 1. 42cm^{-3} for c, aa, bb and dd, respectively. In2017 and 2018 cropping seasons bb observed at 45 dap ranged between 1. 42, 1.47, 1.43and 1. 49respecively. Bulk density values at 2016, 2017 and 2018 cropping seasons increased in the order c>aa>bb>dd. The table additionally showed better bbvalues at ninety dap, in all of the cropping seasons.

Table 4: Impact of spent lubricant oil on bulk density (gcm^3)

Treatment	2016		2017		2018	
	45	90	45	90	45	90
Control (C)	1.42	1.48	1.43	1.49	1.43	1.50
Aa	1.45	1.50	1.46	1.52	1.47	1.51
Bb	1.48	1.51	1.47	1.53	1.47	1.52
Dd	1.50	1.54	1.47	1.54	1.49	1.52
FLSD (0.05)	0.03	0.02	0.01	0.02	0.02	0.02

Where (aa) 2.5 litres, (bb) 5.0 litres (dd) 7.5 litres

3.3.3 Impact of Spent Lubricant Oil on General Porosity (tp%)

Table5 indicates that software of spent lubricant oil extensively (p = zero. 05) decreased soil general porosity (tp) relative to the control in the three cropping seasons. But non-giant increase changed into located most of the treatments at ninety daps in all the cropping seasons. The very best tp price (46%) at forty five dap in 2016 cropping season turned into determined within the manage. The determined value forty six% changed into better than the values in aa, bb and dd by forty five, forty four and forty three % respectively. In 2017 and 2018 cropping season tp values at forty five dap ranged between 43 – forty four% and forty four. Forty five% respectively. Discovered tp values in ninety dap were better than tp values at forty five dap in all cropping seasons. Total porosity values at 90 dap in all cropping seasons have been non-considerable.

Table 4.5: Spent Lubricant Oil on Total Porosity (%) (tp%)

Treatment	2016		2017		2018	
	45	90	45	90	45	90
Control (C)	46	44	46	44	44	43
Aa	45	43	45	42	45	42
Bb	44	43	45	42	45	42
Dd	43	42	42	42	45	42
FLSD (0.05)	1.00	NS	1.00	NS	0.50	NS

Where (aa) 2.5 litres, (bb) 5.0 litres (dd) 7.5 litres

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3.3.4 Effect of spent Lubricant Oil on Hydraulic Conductivity and Aggregate Stability and Moisture Content

The combination stability become considerably (p = 0. 05) higher in control as compared to aa, bb and dd in 2016, 2017 and 2018 cropping seasons (table 4. 6). The bottom combination stability (as) cost of 36% in 2016 cropping season changed into determined in dd plots. This value 36% become decrease than as values in bb, aa and c via 6%, 17% and forty four% respectively. The order of boom in as in 2017 became c >aa> bb >dd while as ranged among 32-55% in 2018 cropping season. Moisture retention (mc) turned into determined to be substantially higher in the manipulate than in the spent lubricant infected plots within the 3 cropping seasons. In 2016 cropping season determined mc of the manipulate (c), aa, bb and dd have been 22, sixteen, 18 and sixteen respectively. In 2017 the values had been 21. Zero for c, 15 for aa, 17 for bb and 15. Eight for dd, moisture content material ranged among 16. Five – 20.1 in 2018 cropping season. Higher hydraulic conductivity values have been determined in c as compared to spent lubricant contaminated plots in all of the cropping seasons. Hydraulic conductivity (hc) ranged between 75. 2 – 82. 9 in 2016 cropping season. The order of boom in hc in 2017 cropping season became c >aa> bb > dd. In 2018 cropping maximum and lowest hc values have been discovered in c and dd respectively. In all of the planting season discovered hc values were low in dd plots compared to other treatments.

Table 6: Impact of Spent lubricant oil on hydraulic conductivity (hc),aggregate balance (as) and moisture content material (mc)

Treatment	2016			2017			2018		
	Hc(cmlr^{-1})	As(%)	Mc(%)	Hc(cmlr^{-1})	As(%)	Mc(%)	Hc(cmlr^{-1})	As(%)	Mc(%)
Control (C)	82.9	52	22.0	82.6	53	21.0	82.6	55	20.1
aa	80.2	42	20.0	79.6	41	20.0	88.8	39	19.0
bb	79.1	38	18.0	78.9	36	18.0	77.8	36	17.9
dd	79.2	36	16.0	75.9	34	16.0	77.8	32	16.5
FLSD (0.05)	1.77	7.11	2.58	2.75	8.52	2.20	5.2	12.51	1.49

Hydraulic Conductivity (HC), Aggregate Stability (AS) and Moisture Content (MC)
where (aa) 2. Five litres, (bb) five. Zero litres (dd) 7. Five litres

3.4 Chemical Residences

3.4.1 Impact of spent lubricant on excheangable basis calcium (ca), magnesium (mg), potassium (ok), and sodium (na)

Exchangeable cations of calcium, magnesium, potassium, and sodium were extensively (p<0. 05) higher in control relative to plots contaminated with spent lubricant oil (table 7). In 2016 cropping season na value in c was 76%, 75% and 43% higher than na values in aa, bb and dd plots, respectively. The order of increase in na values in 2017 and 2018 cropping seasons were c >aa> bb >dd and ca> bb and dd, respectively. In 2016, 2017 and 2018 cropping seasons determined ok values ranged between 0. 06 – zero. Eleven, zero. 04 – 0. 08, and zero. 03 – zero. 07 respectively. Located mg values in c turned into 27, 45 and 33% higher than the mg values in aa, bb and dd handled plots in 2016 cropping season. In 2017 and 2018 cropping seasons the order of mg boom changed into c >aa> bb >dd and c > bb >aa>dd, respectively.

Table 7: Effect of spent lubricant oil on soil exchangeable bases (ca, mg, na, okay)

Treatment	2016				2017				2018			
	Na	K	Mg	Ca	Na	K	Mg	Ca	Na	K	Mg	Ca
Control	10.03	0.11	6.15	5.70	4.31	0.08	6.38	5.70	2.32	0.06	6.38	5.70
aa	2.46	0.07	4.50	6.20	3.04	0.05	4.50	3.20	1.32	0.04	4.30	3.10
bb	2.59	0.06	4.25	6.30	2.47	0.03	4.25	3.40	1.53	0.04	4.35	3.00
dd	2.30	0.08	4.10	6.0	2.25	0.04	4.00	3.10	1.30	0.03	4.25	3.00
FLSD (0.05)	0.31	0.02	0.06	0.26	0.36	0.005	0.005	0.27	0.02	0.005	7.04	1.15

Where (aa) 2.5 litres, (bb) 5.0 litres (dd) 7.5 litres

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3.4.2 Effect of spent lubricant oil on ph, phosphorus, total nitrogen, natural carbon and available potassium

Table Eight showed appreciably (p<0. 05) lower soil ph, available p, total n and organic carbon in the spent lubricant oil amended plots relative to the control in the cropping seasons. Soil ph increased in the 2016, 2017 and 2018 cropping seasons was in the order dd> bb >aa> c, dd = bb >aa> c and dd> bb > cc > c respectively. Available p ranged between 2. 6 – five. 6, 5.Three – five.Eight and five. 2 – five. 7 mgkg-1 in the first, 2nd and third cropping seasons respectively. The best oc% value of zero. 2% in 2016 cropping season become located in c. This price changed into 25%, forty two% and 58%, better than found values in aa, bb and dd respectively. The order of growth in oc% in 2017 and 2018 cropping seasons were c > bb >aa = dd, and c >aa> bb > cc respectively. General n% values had been discovered to be lower in the spent oil amended plots relative to the manage within the three cropping seaons. The bottom tn values of zero. 05, 0.14 and 0. 06% were found in dd amended plots in 2016, 2017 and 2018 cropping seasons respectively. The studied parameters had been determined to lower with growth inside the rate of utility of spent lubricant oil in all of the cropping seasons.

Table 8: Effect of spent lubricant oil on ph, overall nitrogen (tn) n%, organic carbon (oc%) and to be had p (avpmgkg-1)

Treatment	2016 pH	AvP mgkg^{-1}	Oc%	TN%	2017 pH	Av P mg kg^{-1}	Oc%	TN%	2018 pH	Av Pmgkg^{-1}	Oc %	TN%
Control (C)	5.20	5.60	0.12	0.40	5.22	5.80	0.12	0.18	5.00	5.70	0.10	0.17
aa	4.80	3.20	0.09	0.11	4.60	5.20	0.09	0.11	4.50	5.0	0.07	0.10
bb	4.40	2.80	0.07	0.09	4.40	5.40	0.07	0.12	4.30	5.40	0.06	0.08
dd	4.00	2.60	0.05	0.05	4.40	5.30	0.05	0.10	4.00	5.20	0.04	0.06
FLSD (0.05)	0.51	1.38	0.02	0.02	1.07	0.15	0.02	0.05	1.00	0.27	0.01	0.02

Where (aa) 2.5 litres, (bb) 5.0 litres (dd) 7.5 litres

3.4.3 Impact of spent lubricant on exchangeable acidity (ea), cation change ability (cec) and fundamental saturation (bs)

Consequences on table 9 confirmed notably (p = zero. 05) decrease exchangeable acidity (ea) inside the control relative to the lubricant contaminated oil plots in 3 cropping seasons. In 2016 ea became 0. Sixteen within the manage. This cost (0. Sixteen cmolkg-1) changed into 213%, 225% and 306% decrease than ea values in aa, bb and dd amended plots. Determined ea values in 2017 and 2018 cropping seasons ranged among zero. 15 – 0. 40 and zero. 14 – zero. 50 cmolkg-1, respectively.Table 4. 7 also showed drastically (p = 0. 05) better cation exchange capacity (cec) and base saturation (bs%) within the manipulate relative to the tainted spent oil polluted plots. The best and lowest cec values in 2016 cropping season were observed in c and dd plots, respectively. In 2017 cropping season cec ranged between 50 – 92. 2%. The order of cec growth in 2018 cropping season become c >aa> bb > dd. Base stuaration values in 2016, 2017 and 2018 ranged between fifty six. 6 – ninety six%, sixty three – 90% and 50 – 85% respectively.

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Table 9: Effect of spent lubricant oil on exchangeable acidity (ea), cation trade ability (cec) and base saturation (bs)

Treatment	2016			2017			2018		
	EA ($cmolkg^{-1}$)	CEC	BS(%)	EA ($cmolkg^{-1}$)	CEC	BS(%)	EA ($cmolkg^{-1}$)	CEC	BS(%)
Control (C)	0.16	92.8	96	0.15	92.2	90	0.14	92.3	85
aa	0. 05	69.0	48	0.45	60.0	67	0.43	53.3	55
bb	0.52	69.5	65	0.45	64.0	65.6	0.47	54.5	53
dd	0.62	56.4	56.6	0.40	58.0	63	0.50	52.1	50
FLSD (0.05)	0.22	14.68	3.20	0.23	44.59	1.25	0.23	1.01	2.64

Where (aa) 2.5 litres, (bb) 5.0 litres (dd) 7.5 litres

IV. DISCUSSION

Consequences of the observe in table 1 showed that the soil is a sandy, loam with low percentage natural carbon (oc%) and overall n %. Table 1 additionally showed that once observe for three years, the textural elegance did no longer alternate, it remained sand loam. This confirms the file of obasi (2004) that texture is a everlasting belongings of the soil. In step with Nwite (2013) texture of soils has suitable dating with nutrient garage, water retention, porosity, soil compatibility, soil unique floor region and compressibility which affect inherent productivity of soil. The better values of bulk density (bd) determined in spent oil handled plots can be as a result of the spent oil on soil pores.

The spent oil may have misplaced the soil pores. The growth in bulk density in treated soils propose that water infiltration of soil is reduced in the soil. Discount in water infiltration charge of soil confirmed that the porosity of soil may additionally have been affected. The situations obviously impacted nutrient biking and the viable up take of vegetation as recommended by (Omoju and Okenyi 2012). The end result indicates that the soil is compact and can avert speedy root increase and ultimately crop productivity. The end result additionally help the findings of Stoskopf (1981) which agreed that high bulk density values leads to compaction and can't permit rapid root boom and feasible powerful crop yield. The trouble of compaction can also have resulted from the treatment applied. The trouble here may additionally as well be because of the previous tillage because of constant cultivation of the plot. Compaction of soil on account of consistent cultivation can affect the soil pore spaces in that water may be trapped at lower matrix factors and such trapped water can in no way be made available to flora. It's also viable that soil can be hindered and water is never free for soil microorganisms habitation, statistically the bulk density is non vast inside the treatment in the 3 years.

The bodily and chemical residences which impacts at the soil productivity and crop performance are decided on and they display that the ph values of the website in the three years or all slightly acidic as compared to the preliminary ph of 5. 6. The end result indicated that they are non substantial within the remedy in 2016 and they're extensive inside the remedies in 2017 and 2018. The variation in pH in the 3 years did now not argue with Gomez et al., (2001) which opined that detection within the soil takes up to 5 years. It is obvious in the result that the site is barely acidic as it shows little variant in acidity level a few of the treatment, within the length of take a look at as compared to the initial ph level of five. 6 (H_20).

Fields and laboratory research have discovered that spent oil on landing at the plants penetrates the leaves and therefore interferes with its functioning mainly with the aid of reducing transpiration and phytosynthesis in which spent oil pollution is light, the leaves and drops quickly after, however beneath heavy pollutants, whole dropping of leaves results. The plant life may want to however recover until the soil itself is closely polluted (Nwite, 2013). The adverse impact on spent oil pollution of the soil on agriculture as a consequence consequences in the soil ultimate fallacious for crop boom relying on the diploma of pollution the soil may additionally stay improper for crop growth for months or years (Nwenja, 1998). But, crop is commonly improved under moderate pollutants of the soil order of one% or under and this simulation of crop increase is attributed to nitrogen fixation within the soil addition of nutrient from oil-kill microorganisms or from the oil itself (Nwoko, 2007).

This look at change that allows you to discover the impact of spent lubricant oil on soil and water fine. The result suggests that spent lubricant oil contamination degraded soil physio-chemical and organic homes.

V. CONCLUSION

Impact of soil at exclusive levels with spent lubricate oil prompted soil degradation thru expanded bulk density, low general porosity and decreased gravimetric moisture content material, hydraulic, conductivity and mixture stability. The provision of soil nutrient became depressed lowering nitrogen, natural carbon, available phosphorus, cation exchange capacity, base saturation and exchangeable cations. This observe has demonstrated that effect of spent lubricant oil on soil and water nice has the capacity to explain impact of spent lubricant oil contamination of soil, lower physio-chemical and organic residences and generally reduced its productiveness.

VI. RECOMMENDATION

Therefore, it may be appropriate to recommend the following:

i. There's want for people to be cautious and keep away from spent lubricant oil contamination of soil due to its capability degradation of soil.
ii. There may be need to arouse the worldwide groups, oil corporations and NGOs at the dangers of spent lubricant oil contamination of soil and solicit for extended help in soil reclamation.
iii. Artisans who deal on hydrocarbon oil in addition to mechanic village have to be nicely positioned faraway from agriculture land and settlements.

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