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Effects Of Crude Oil Spill In Germination And Growth Of Hibiscus *Esculentus* (*Okra*) Inbayelsa State Niger Delta Region Of Nigeria

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ABSTRACT
The effects of crude oil in plant germination and growth were investigated using Hibiscus esculentus. A total of 15 pots having 2 viable. Hibiscus esculentus seeds each; containing 20 kg of loamy soil were investigated. Pots were used as control experiment, 5 had crude oil applied before planting seeds at levels of 100ml 150ml, 200ml, 250ml and 300ml and 5 had crude oil applied in soil after germination of seeds. It was observed that seeds in the control pots had normal growth, where as in the crude oil applied soil before planting, seeds had no germination and those in crude oil applied soil after planting, the plants had stunted growth.

KEY WORDS:*Crude oil, hibiscus esculentus, seeds, growth, and germination*

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I. INTRODUCTION

The increasing rate of crude oil pollution on farm lands in particular and generally to our environment is one, which is a disturbing reality to the inhabitants of areas that are affected and also to the companies that are involved in the oil prospecting and exploration.Crude oil is a natural inheritance present in the beds of ancient seas. It is a complex and varied mixture of a number of hydrocarbons with small amounts of sulfur, nitrogen and oxygen. It is believed to be of organic origin, which occurs, naturally in the upper strata of the earth in various parts of the world. There are different types of crude oil and this is a function of the different amount of different hydrocarbons and other sub molecules.Crude oil especially from different field varies widely in physical and chemical properties.As mentioned, crude oils are essential mixtures of hydrocarbons, but not all hydrocarbons are present in every crude oil and in situations where the same hydrocarbons are present they are usually not present in the same proportion. This gives the basis for the formation of different types of crude. The character ofcrude oil is determined by the kind of hydrocarbons it contains and the proportions in which they are mixed.Nearly all crude are lighter (less dense) then water and flow quite readily, but some are heavy and do not flow freely. Crude from one field may be almost colourless; that form another black, but usually the colour varies from light amber to light and dark green and brown.Small amounts of sulfur, nitrogen and oxygen are mixed with the hydrocarbons. Some crude have high sulfur content; those are called sour crude because of their odour. Those with low sulfur content are called sweet crude.The hydrocarbon molecules in petroleum vary in the number of hydrogen and carbon atoms and in the pattern in which the atoms are arranged. Those with a large number of carbon atom make up the thicker and heavier parts or fractions of crude oil such as asphalt.Other molecules with small number of atoms make up the lighter and more volatile fraction such as gasoline. With the knowledge that crude is found beneath the earth surface we may ask how one can access crude and this is done by drilling. After crude has been drilled, it has to be refined to suit human needs.

Crude is usually transported to the refineries and this is the part that is of great disturbance because in the process of transportation a lot of spillage occurs - such as spillage from tankers, leakage from of shore wells, leakage from pipelines and trucks and even from underground storage tanks. After crude has being refined an amount of waste is produced and some times this waste is discharged into oceans which may flow to land, later causing pollution on farm lands.When pollution of land occurs (farmland) most times research is carried out on such land in other to know the level of damage caused so that compensation and treatment of the land can commence.Hibiscus *esculentus* (*okra*) is a garden plant closely related to the hibiscus. This plant is popularly used in Nigeria by more than 60% of the country's human population.It produces pods eaten in soups arid stews and as a Fried or boiled vegetable. It is grown as a fruit vegetable in most of the West African countries. The plant grows up to 3 meters or more with the dwarf variety reaching 1 to 1. 5 meter in height.

It has a hairy wooden stem and a tap root system. The leaves are hairy broad, large and bright yellows. The pods grow up to 5-10cm in length.Hisbiscus *esculentus* is a source of carbohydrate, some protein and mainly vitamin A and this gives the plant medicinalimportance since vitamin A promotes the formation of visual purple, an eye pigment that is destroyed by light. The vitamin A present in this plant also is very necessary in keeping the skin and mucous membranes healthy and is necessary for the normal formation and growth of bones and teeth. Okra also has some economical importance as it has been exported as food to other countries. The effect of crude oil pollution on plant growth and germination varies according to the type and amount of oil spillage involved. The degree of its weathering, the time of year and the specie and age of the plant or plants concerned. The effects that have been observed include the oil-trapping ability of vegetation, the yellowing and death of oiled leaves, a great reduction of seedling and of annual species, differing susceptibilities and recovery rates of perennials, a competitive advantage to some species, and growth stimulation. Chronic pollution may completely eliminate germination hence no vegetation.

Pollution, whether it is acute (the result of one accidental spillage or intentional dumping) or chronic (arising from continuous or regular discharge) has deleterious effects upon the ecosphere. This is clearly borne out by the evidence accumulating from a number of previous works done in temperate countries. [1] demonstrated the penetration of crude oil through stomata into plants. Plants with heavy cuticles and few stomata permit little penetration of oils e.g. some xerophytes, are resistant after 8 hours exposure.[2] studied the penetration of refined petroleum (0.0ls) into the tissues of plants and noted high penetration of emulsified oils- showing that viscosity and surface tension influences the rate at which an oil will spread over and penetrate into a plant.After penetrating the surface of a leaf, the oil moves into the intercellular spaces.[3]; [4]; [5]; [6]; [7] and may then travel within the plant. The toxic effects of crude oil on contact with and upon penetration into plant tissues have also been the subject of considerable work as early as 17^{th} century. [8]were the first to make the distinction between rapid or acute injury caused by light oils and slow or chronic injury resulting from heavy oils. This was later elaborated by [9] who classified injury into 3 categories:

1. Acute injury from volatile unsaturated compound.
2. Acute injury from volatile acidic compounds.
3. Chronic injury from high boiling unsaturated upon exposure to light and air.

There is agreement that phytotoxicity increases along the series: paraffin, naphthalene and olefins aromatic [9]; [10]; [11]. Within each series of hydrocarbons, the smaller molecules are more toxic, while duodecane and higher paraffin are nearly non-toxic. However 12- carbon atom olefins are quite toxic and 12-carbon atoms aromatics are more so [12].[13]tested barley and carrot with hydrocarbon vapors and found that toxicity increased along the hexane- hexene- cyclohexene- benzene series.

[13] had reported an increase in toxicity along the series: benzene - toluene - Xylene - trimethylbenzene, and had concluded that the increase in number of methyl groups promoted penetration and toxicity could be inversely correlated with water solubility Considerable work has also been carried out using simulated or experimental crude oil spills to study effects of crude oil pollution on natural or cultivated plant communities Most of these researches, especially pertaining to arctic, terrestrial and aquatic communities have been reported or summarized in a number of more resent publications, notably [15], [16], [17], [18], [19], [20],[21], [22], [23].

In one experimental crude oil spill made by (Hutchinson and Freedmen (1978) on two sub artic boreal forest plant communities near Norman wells, spray, spills of fresh Un- weathered crude oil at an intensity of 9.1 1/2 had a general herbicidal effect and caused death of any green tissue coming in direct contact with the oil. Death of lichens and mosses was rapid arid and complete. For some higher plants a considerable lag period occurred between the time of the spill and the time of death. [18]also determined that an intensive (8,500 liter) spill made at one point is less damaging than dispersed spray spills per unit of oil applied to the plant community, with severe detrimental effects being largely limited to areas of direct contamination.

[24]investigated the effects of number 2 fuel oil, Nigerian crude oil and used crankcase oil. They reported an acute and chronic toxicity of their water—soluble constituents.Due to the frequency of petroleum spill damage to turf grass areas, a field study was conducted on ‘Tif green’ Bermuda grass (cynodon I species) by [19] to determine the injuries, symptoms and subsequent recovery rates from petroleum spill damage. Injury symptoms were documented and Bermuda grass was found to recover rapidly (3-4 weeks) from gasoline spills without corrective procedures.[25]investigated the effects of crude and diesel oil spills on plant communities at Prudhoe bay, Alaska. Spilling crude oil on six of the major Prudhoe bay plant communities at an intensity of 121/rn2. They found that sedges and willows showed substantial recovery from crude oil spills, mosses and lichens and most dicots showed little or no recovery on a wet plot withstanding water, the vegetation showed total recovery one year following the spill. Dry plots on the other hand showed very poor recovery *Dryasintergrzfoha*, the most important vascular specie on dry sties was killed.

II. EFFECT OF CRUDE OIL ON SOIL

The effect of crude oil pollution in plant growth and germination seem to depend on the level of pollution and the period the oil has remained in the soil.If oil is sprayed on vegetation, it penetrates into the plant tissues, through the sensitive stomata, the thin cuticle and also through the epidermis. These penetrations are made possible by its transfer through the vascular system of the plant [26].According to [27], crude oil spillage on soil makes it unsatisfactory for plant growth. This is due to insufficient aeration of the soil because of displacement of air form the pore space between the soil particles by crude oil.

Similar reports have been made by [28], [20], [29] and [30].

[21]reported that waste oil causes a break down of soil texture, followed by soil dispersion. However, [21] continues by saying that the presence of fresh crude oil has coagulatory effects on the soil, binding the soil particles into a water impregnable soil block, which seriously impair water drainage and oxygen diffusion. He further stated that seeds sown in such soil failed to germinate.It is obvious that a soil already contaminated with crude oil has deleterious effects as: killing of plant on contact, or retard the growth as well as inhibit germination and this is already established. This is due to the fact that it enhances the inhibition of activities of the soil micro-organisms by delimiting free water supply and aeration [31]. Though crude oil may be toxic, [32] reported that crop growth could be stimulatedby soil contaminated of the order of one percent. Similar results were also obtained in a simulated pollution study by [33] using different levels of crude oil.[34]found that a pollution level as low as 10% crude oil in the soil suppressed the growth of Okra plant. While [35] found that at zero level of crude oil, 90% grains planted germinated, but as the level of crude oil increased, the percentage of germination decreased. It is often obtained that were there is fresh engine oil pollution on soil, especially in mechanic workshop, nothing grows there, and this may be due to fixation of nitrogen or addition of nutrients from oil killed organisms or possibly due to an increase in humus content of the soil [32].

EFFECT OF CRUDE OIL ON PLANT

Seed germinations seem to be affected by oil at least in two ways. At high level of crude oil pollution, seed germination is prevented probably by oil soaking through the outer integument of the seeds. At low level of crude oil pollution, seed germination is retarded by the presence of oil [36]. This seems to be varied between different plant species in their ability to germinate in the presence of crude oil (stress).[27]germinated seeds in repeatedly polluted soil that were moist to field capacity. He found that the germination of sorghum was poor, whereas that of rye grass was not affected when compared to that of the control. The effect of crude oil on plant is one that is of great concern as it causes damage to different parts of the plant that are vital for its well being and survival and hence obstructs development and growth.[34]showed that the leaves of plants affected by oil tended to dehydrate and show a general sign of chiorosis, indicating water deficiency.The reduction of leaf area may be due to dehydration. The study agreed with the work of [37] who found that reduction in photosynthetic rate resulted in the decreased rate of growth, which led to the reduction of leaf sizes.[38]observed that the volatile fraction of oil had a high wetting capacity and penetrating power and when in contact with seed, the oil would enter the seed coat and kill the embryo readily, which will in turn, cause reduction in percent germination. [36]found that the significant reduction in final germination percentage of all the species may be due to toxic effects of the crude oil on the seed and poor aeration of the soil.

From various experiments, it has been elucidated that crude oil spillage would affect plants in the following ways:

[1] Inhibit the germination of plants.
[2] Delay germination by inducing stress, which prolongs lag phase.
[3] Inhibit the uptake of water and nutrients by the root of the plant, hence causing deficiency to other parts as the leaves.
[4] Affects regeneration of stumps.
[5] Affects anatomical features of leaves.
[6] Causes cellular and stomatal abnormalities.
[7] Disruption of the plant water balance, which indirectly influences plant metabolism.
[8] Causes root stress, which reduces leaf growth via stomata conductance.
[9] Causes ‘chlorosis’ of leaves.
[10] Enlargement of cells in various’ tissues due to oxygen starvation were cells coalesce forming large cells in tissues.

Causes considerable reduction in plant height, plant girth and even leaf area.
The ultimate effect of crude oil on plant is in its resultant death. The works of [15], [39] put together with many more works support these facts on the effects of crude oil on plant growth.

This study is to determine the effect of oil spillage on hisbscusesculentus (Okra) and thereby elucidate the harm done by oil exploration to the economic mainstay of the people of the Niger Delta.

STUDY AREA : AgudamaEpie has a humid type of climate, which is peculiar to the tropics with a short dry season from December to February, and long wet season, which starts from March to November. The area, Agudama-Epie, has an average rainfall of between 759mm to 1,500mm, with an average temperature of 18°C to 30°C

VEGETATION : Agudama-Epie is in the rain forest, swampy in nature, and has trees and grasses of luxuriant vegetation of the tropical rain forest type e.g. Mangiferaindica (Mango), Milicia excel (Palm tree) are found in the experimental area.

III. MATERLALS AND METHODS

EXPERIMENTAL DESIGN

Okra (Hibiscus esculentus) seed of a short stem variety was obtained from Agudama-Epie market in Bayelsa State, Nigeria.

SOIL PREPARATION

Sandy loam soil was collected from the Department of Agricultural Science School farm, Bayelsa college of Arts andScience, and weighed. Fifteen (15) planting pots of 20kgcategory were used.Other materials were crude oil, which was gotten from the Nigerian Agip Oil Company, a cylinder and beaker for measurements. Soil samples were collected from BayelsaState College of Arts and Science the Department of Agricultural Science Schoolfarm. It was dried and broken into small particles. It was then sieved to remove stones and sand. An amount of soil weighed out into each planting pot.

TREATMENT

The experiment involved (3) different groups. Which consisted of (5) planting pots in each group containing Loam soil. Group A was the control and contained absolutely no amount of crude oil. It was left under normal conditions of temperature, sunlight and water.

Group B: a test group that contained (5) different planting pots, but with the soil treated with crude oil before planting, in increasing amounts of crude in the different pots as follows:

1st Bucket:	l00 ml of crude oil
2nd Bucket:	150ml of crude oil
3rd Bucket:	200ml of crude oil
4th Bucket:	250ml of crude oil
5th Bucket:	300ml of crude oil

The third group. That is group (c) had (5) buckets in which the soil was not treated before planting rather. Crude oil was introduced into the bucket containing soil after planting and seeds had germinated. The crude oil was introduced 2 weeks after planting in the manner described below:

1st Bucket:	l00mI of crude oil
2nd Bucket:	150ml of crude oil
3rd Bucket:	200ml of crude oil
4th Bucket:	250ml of crude oil
5th Bucket:	300ml of crude oil

CRUDE OIL APPLICATION

Crude oil application was done on separate days for the (2)different test groups. Group (B), which is treatment before planting, was done to commence the experiment. Group(C) which is treatment after germination was done 2 weeks after.

IV. DATA COLLECTION PROCEDURE

Plant Height: Plant heights were measured weekly starting from a week after planting. For collection of height data, the plants were randomly tagged in each experiment until their heights were measured from ground level to tip of the terminal, bud, using a meter rule on the 1st and 2nd week after planting. The data that was collected (obtained) from the measurement were computed and the height of plant for each treatment was determined and recorded.

Leaf Area: Leaf length and leaf area index was taken on the 1st and 2nd week after planting.

Plant Girth: Stem circumference was taken at the 1st and 2nd week after planting and this was done using a thread and meter rule.

V. RESULTS AND DISCUSSION

The results are presented in graphs, tables and plates as shown below.

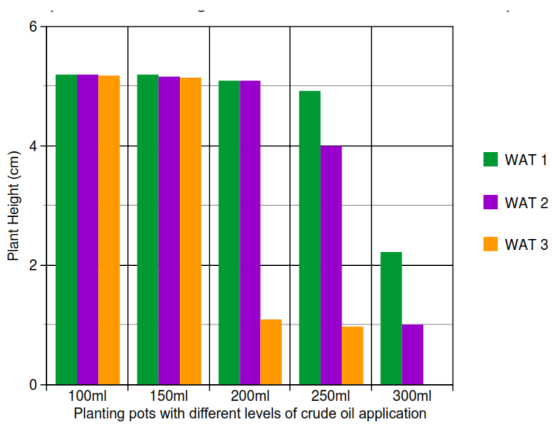

Figure1: Comparison of Plant Height between Different Treated Pots of Group C
WAT = week after treatment, PL = plant death

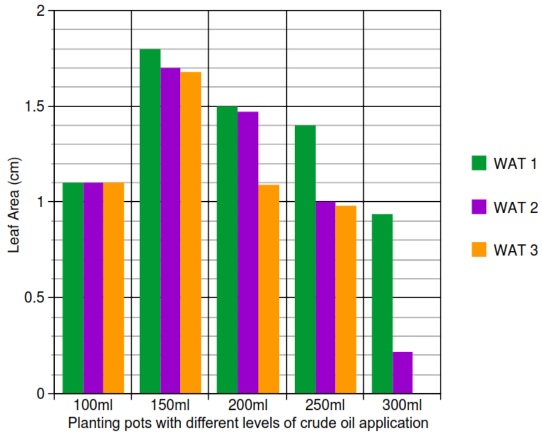

Figure 2: Comparison of Leaf Area between Different Treated Pots of Group C
WAT = week after treatment, PL = plant death

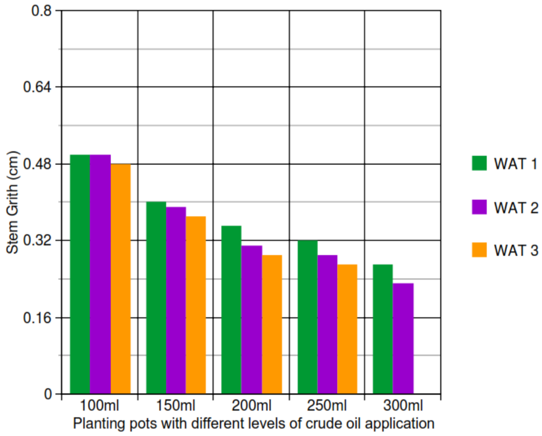

Figure 3: Comparison of Stem Girth between Different Treated Pots of Group C
WAT = week after treatment, PL = plant death

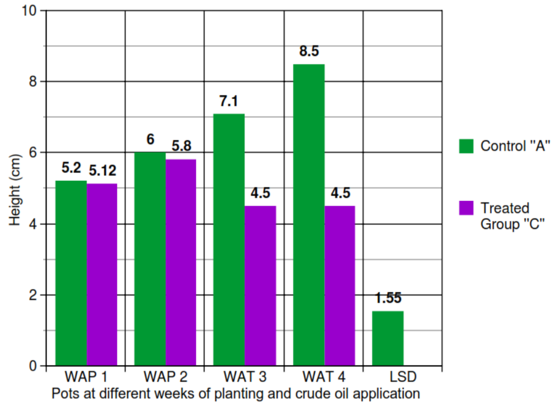

Figure 4: Comparison of Plant Height between Control (Group A) and treated pots (Group C)
WAP = week after planting, WAT = week after treatment, LSD = least significant difference

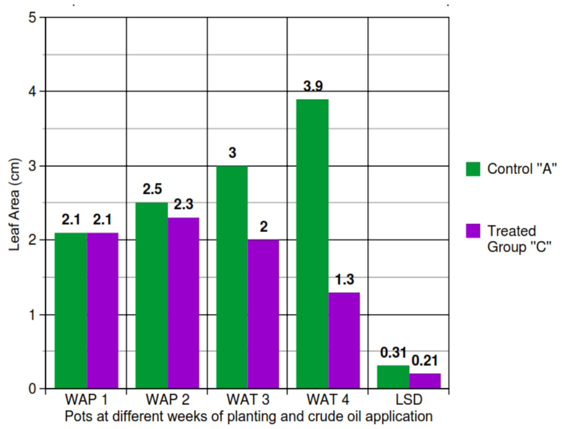

Figure 5: Comparison of Leaf Area between Control (Group A) and treated pots (Group C)
WAP = week after planting, WAT = week after treatment, LSD = least significant difference

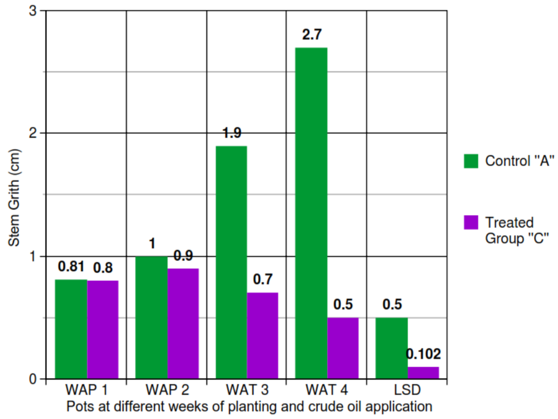

Figure 6: Comparison of Stem Girth between Control (Group A) and treated pots (Group C)
WAP = week after planting, WAT = week after treatment, LSD = least significant difference

Table 1: **ANOVA TABLE FOR PLANT HEIGHT**

Variance	Df	S.S	M.S	F.cal	**F.tab**	
Treatment	2	69.53	34.77	1.09	1% 0.01	5% 0.05
Error	7	285.65	31.74		99.50	19.50
Total	11	31.74				

ANOVA (Analysis of variance)
Hi: There is significant effect of crude oil on plant height.
Ho: There is no significant effect on plant height
Decisions rule: Fcal>Ftab at 1% and 5%, we accept Hi and reject Ho.
F cal = 1.09
F tab at 0.01 = 99.50
F tab at 0.05 = 19.50
Since F cal> F tab, at 1% and 5%. We accept Hi and reject Ho.
Conclusion: crude oil has effect on plant height

Table 2: **ANOVA TABLE FOR PLANT LEAF**

Variance	Df	S.S	M.S	F.cal	**F.tab**	
Treatment	2	12.25	6.12	1.09	1% 0.01	5% 0.05
Error	7	50.56	5.62		99.50	19.50
Total	11					

ANOVA (Analysis of variance)
Hi: There is significant effect of crude oil on leaf area
Ho: There is no significant effect on leaf area
Decisions rule: Fcal>Ftab at 1% and 5%, we accept Hi and reject Ho.
F cal = 1.09
F tab at 0.01 = 99.50
F tab at 0.05 = 19.50
Since F cal> F tab, at 1% and 5%. We accept Hi and reject Ho.
Conclusion: crude oil has effect on leaf area.

Table 3: **ANOVA TABLE FOR PLANT GIRTH**

Variance	Df	S.S	M.S	F.cal	**F.tab**	
Treatment	2	3.099	1.549	0.88	1% 0.01	5% 0.05
Error	7	15.835	1.759		99.50	19.50
Total	11					

ANOVA (Analysis of variance)
Hi: There is significant effect of crude oil on plant grith
Ho: There is no significant effect on plant grith
Decisions rule: Fcal>Ftab at 1% and 5%, we accept Hi and reject Ho.
F cal = 0.88
F tab at 0.01 = 99.50
F tab at 0.05 =19.50
Since F cal> F tab, at 1% and 5%. We accept Hi and reject Ho
Conclusion: crude oil has effect on plant girth.

Plate1: Photograph showing hibiscus esculentus under norm conditions (control experiment without the application of crude oil)

Plate2: Photograph showing soil with crude oil before planting of hibiscus esculentus.

Plate3: Photograph showing effects of crude oil application on hibiscus esculentus after two weeks of planting.

VI. EFFECT ON GERWMINATION

Group A - Control - All seeds germinated. Plant showed luxuriant leaves, sterns and growth was normal as shown in plate 1, figure 4, 5 and 6.

Group B- No seed germinated as shown in plate 2, the entire experiment had been concluded.

Group C-All seeds germinated but progressively deteriorated after application of crude oil showing signs of stress, wilting decoloration and stunting as shown in plate 3, figure 1, 2 and 3.

EFFECT ON PLANT CHARACTERISTICS

a) Plant Height: There was a significant difference between the control (group A) and the treated plants in group C as shown in plates 1 and 2, table1 and figure 4. This phenomenon was more visible during the 3rd and 4th weeks after planting, during which periods; crude oil had been introduced in the pots.

b) Leaf Area: There was a significant difference between the control (group A) and the treated plants in group C as shown in plates 1 and 2, table 2 and figure 5. Mean leaf area decreased during the period the plants were treated with cruder oil.

c) Plant Girth: The largest stem girth was in the control during the 4th week of planting. There was a decline in girth size in the treated plants as the weeks increased as shown in plate 3, table 3 and figure 6.

The longer lag phase preceding germination and the absolute germination percentage were obviously due to some inhibition of germination in pot treated with crude oil before planting.This inhibitory effect could be attributed principally to physical constraints as well as biological harm on the seed resulting from the physical and chemical characteristics of crude oil.Crude oil or its distillates are potent contact herbicides (Hutchinson and Freedman 1978). The embryo of a seed could be injured or killed if it comes in contact with crude oil. Crude oil may enter seeds via the micropular end of dicotyledonous seeds or simply through a crack or any injury. Whichever way, penetration of crude oil would certainly endanger the life and growth activities of the embryo, which are vital to germination. This agrees with the view of [40] who suggested that delay in germination of seeds of Salicornia spp. And S. maritime on Milford Haven salt march, which had been polluted by fresh Kuwait crude oil, could be clue of oil entering the seed and killing the embryo.Injury to the embryo if not fatal could result in delayed germination longer lag phases. Hence the complete inhibition of germination in this experiment simply indicates that crude oil levels of l00ml and above cause sever injury to H. esculentus seeds and therefore, inhibited germination completely.Outright killing of the embryo of some seeds due to penetration by the crude oil would certainly result in lower absolute percentage germination. This contention is plausible bearing in mind the reported toxic effects of crude oil on the biota.

The work of [41]; [9]; [10]; [11] as well as works of [21], [20], have provided a basis for agreementon the toxicity of crude oil to living tissue.Another possible reason for the inhibition of germination by crude oil is its physical water repellant (or hydrophobic) property. The persistent film of oil around the seeds may act as a physicalbarrier, preventing both water and oxygen uptake which re essential for germination. This would impose considerable stress on the physiology of the germinating -seed and when there is an increased amount of crude oil, stress is increased and so germination is completely inhibited.It is in the agreement with the submission of [42] that the first process which occurs during germination is uptake of water by the seed and this uptake is due to the process of inhibition. The extent to whichinhibition occurs is determined by the permeability of the seed or fruit coat to water, seed composition and availability of water in liquid or gaseous form. Clearly, the permeability of the seed coat to water is rendered almost zero by the hydrophobic film of oilcovering the seed, a physical barrier which precludes the available moisture in the soil from getting imbibed into the seedfor the mobilization of the essential molecules whose activities would stimulate the dormant seed into germination.

The fact that germination is a process related to living cells and requires an expenditure of energy is well known. Energyexpenditure in germinating seeds as in all living systems depends on the process of oxidation, which may require gaseous exchange.The taking in of oxygen and the release of carbon dioxide [43]. It is therefore, possible that the inhibition of germination of soil treated with crude oil (now containing oiled seeds) is partly due to the preclusion of this vital gaseous exchange by the oil film covering the seeds.Thus a delay in the inhibition of the required volume of water and an uneasy gaseous exchange together with an inadequate amount of the essentials reaching the seed may have caused the seeds not germinating. The total preclusion of water and oxygen from the seeds with thick oil coat would result in no germination (remaining dormant until the seed rot away). Another factor that may have contributed to the inhibitory effects of crude oil on germination is the increased microbial activity in treated soil, which may have further depleted available oxygen.

This factor, however, appeared to have played no major role in inhibiting germination since the microbia growth around the seeds was not visually observable until after 4 — 7 days when germination undernormal conditions should have taken place.However, [34]attributed poor growth of someplants in oil-polluted fields to suffocation of the plants by exclusion of air or exhaustion of oxygen by increased microbial activity.Stunted growth was observed in treatment C, this result agreeswith the findings of [44] who reported the delay of growth with small amount of crude oil and no growth with large amounts of crude oil It also agrees with previous reports of [21], [20] and [28] Furthermore, the control (A) has a better performancethan treatment (C) showing the effect of crude oil on plants This also agrees with [36] who reported that oil hasadverse effects on plant growth The study gave similar results where there were significant differences in growth between theuntreated and treated plants. A positive relationship has been observed between the extent ofretardation in growth and concentration of crude oil applied to the soil. These findings are in accordance with previous reports of [21], [20] and [28].

Hence, we can say that the significant reduction in the final growth of okra may be due to toxic effects of the crude oil on the needs and poor aeration of the soil and this agrees with the work [34] The biggest leaf area was obtained m treatment A. Treatment C was found to be thin and smaller leaf area.This statement agrees with [26] who said that the increase of leaf area was due to interference of crude oil with photosynthesis and transpiration by clogging the stomata, which suits in the reduction of photosynthetic rates.However, [34] showed that the leaves of plants affected by crude oil tended to dehydrate and show a general sign of chiorosis, indicating water deficiency. The reduction of leaf area may be due to dehydration. This agrees with the work of Boyd and Murray (1982), who found that thereduction in the photosynthetic rate resulted in the decrease of the rate of growth and development in leaf size.

Results of this study show that leaf stomata were grossly affected by crude oil. The effect may have been manifested either in the distortion or reduction in the number of stomata per unit area of the leaf. A strong relationship between degree of disruption and concentration of crude oil in the soil was noticed. This further confirms earlier report of [45].Since the uptake of water and salts (ions) is carried out by the roots, they are being transported to the leaf, presence of oil in the soil will inhibit uptake since crude oil is hydrophobic and this cause lack of water transport to leaves which in turn cause dehydration resulting in shrinking of leaf giving smaller leaf area in plants in soil that are treated. Similar findings have been reported by [46].

VII. CONCLUSION

Application of l00ml and above amount of crude oil soil inhibited germination. In plants that have already germinated the exposure of plants to crude oil at levels of l00ml and above had adverse effects on growth and development as it reduces stem circumferences, leaf length, leaf width and leaf area of the plant. The stem became thinner in size and most of the leaf became yellowish in colour compared with the control, whichhad no level of crude oil in it.Environmental pollution has been shown to have adverse effects on plant growth, especially crude oil spillage.The effect of crude oil will be determined by the concentration to which the particular plant is exposed to it, its persistence in the environment as well as the tolerance of the plant to crude oil and itsconstituent.This suggests that crude oil exposure, even at low concentrations can cause deleterious effects, whether lethal or sub-lethal, to organisms, population or community depending on the time of presences in the environment as well as the tolerance level of the environment and organisms subjected. It is therefore recommended that concentration of crude oil at levels of l00ml and above be avoided to have contact with farm lands and where this fails, immediate cleanup of affected areas be made, to avoid contamination of soil, as well as penetration and uptake of crude oil into already growing plants.

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