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Planning Implications of the Effect of Crude Oil Pollution on Germination and Growth Parameters of Mucuna Pruriens (Var Cochinchinesis) Fabacea in Rivers State, Nigeria

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Abstract: The effect of varying concentrations of crude oil pollution on the germination and growth parameters of Mucuna pruriens (Var. cochinchinenesis) was investigated. The following treatments were used; 0ml, 100ml, 200ml, 400ml, 800ml 1600ml respectively. The germination of velvet bean was 100% but growth was found to be inhibited by a wide range of treatments (800ml and 1600ml). the lag phase of proceeding growth is also reduced at this treatment. Growth inhibition is attributed primarily to the characteristics of oil, which acts as a physical barrier to water and oxygen uptake. It was observed that the plants with the polluted treatments had reduced development and growth as against the non–polluted treatment (control) due to the toxic consequence of the crude oil on the geomorphological parameters (number of leaves, leaf area, and plant height) tested for. Velvet beans treated with lower treatment (100ml and 200ml) were observed to be more productive when compared to the control experiment. Consequently, as the crude oil exceeds the plant absorbing capacity at 800ml and 1600ml respectively, the growth retards, chlorosis, presence of tough apical meristem, and defoliation from the base of the plant.

Keywords: germination; growth; crude oil; botanical garden; morphological parameters

1. Introduction

The continuous contamination of the environment with petroleum hydrocarbons (PHs) is a major threat to agricultural productivity and the health of the soil [1]. Generally, hydrocarbons found in the soil come from the handling of petroleum and its by-products ranging from exploration, refining, haulage, and containment. The demand for petroleum products as an energy source has engendered a phenomenal upsurge in the contamination of the soil especially in most crude oil-dependent developing economies [2]. Usually, the contamination of the soil with hydrocarbons is caused by frequently occurring spillages, even though in smaller quantities [3]. Oftentimes spills from crude oil are linked to deliberate anthropogenic actions, technical failures and faults during haulage and storing [4]. Sometimes continuous generation of wastes from petroleum and their subsequent discharge into the environment forms sludge that often increases soil contamination with toxic heavy metals and toxic hydrocarbons [5]. The consequences on the environment predominantly the soil are phenomenal with little knowledge of the synergistic, additive, or negative impacts of the numerous segments inherent in the mixture of hydrocarbon [6]. Pollution of the soil with crude oil often compromises the capability of the soil to buffer, filter and transform organic and inorganic contaminants [7].

Petroleum hydrocarbons deploy severe toxins on the growth and performance of plants [8–10]. The effect of crude oil pollution on plants is palpable just after the oil spill or a few days after. Plant stress, loss of vegetation, and phytotoxicity are contingent upon the species of plant, nature and extent of pollution are the major obvious phenomena [11,12]. Petroleum contamination hampers the growth of plants by reducing the rate of germination, reducing plants' resistance to diseases and

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pests, and decreasing soil fertility [13]. It is also linked to a substantial decrease in plant richness and biodiversity [12,14]. Distortions of key physiological progressions within plant systems are indifferent and frequently evident as variations in the burnt foliar, morphological, and chlorotic patterns. Thus, the presence of petroleum hydrocarbons is often found in vegetables and fruits leading to significant health hazards [15].

Spillage of petroleum hydrocarbon represents one of the most common contributory factors that significantly engender deforestation and subsequent vegetation loss [16]. If there are any agricultural lands proximate to a crude oil spill site, the lands are rendered impossible to farm on and the crop plants are destroyed [17]. Several reports abound regarding the unproductive nature of some agricultural lands caused by the negative consequences on the fallow land, swamps, and farmland [17,18]. The extent of the destruction distorts the livelihood chain of affected communities evident in reduced crop yield leading to food insecurity and poverty [18,19]. There is a likelihood of a 36% reduction in the ascorbic acid content of vegetables and probable 40% reduction in the crude protein found in cassava and a 60% reduction in the food security of most households [20].

The damaging impact of crude oil spillage on the social and economic activities of individuals and agriculture in the Niger Delta region is phenomenal [21]. It is such that the consequence of crude oil exploration on agriculture and lack of appropriate obligations aimed at cleaning up the environment have a significant contribution to the overwhelming privation leading to persistent disruptions of the social and economic activities by some self-acclaimed agitators (freedom fighters) who further complicate the challenges associated with the pollution of the environmental [22,23]. Diverse laboratory and field studies from the Niger Delta region have emphasised the overwhelming negative impact of crude oil contamination on the marine environment, farmlands, and crop plants [18,21,24,38].

Most of the irregular experiences occasioned by crude oil contamination of the soil include drastic farmland degradation, poor soil aeration, massive reduction of soil fertility, raised temperature of the soil, soil structure obliteration, annihilation of the soil microbial communities, low productivity of the crops, yellowing of the leaves of the crop, stunted growth, wilting of the crop, rotting tubers of the crop, the occurrence of crop diseases and burnt crop leaves [17]. The collective effects of those conditions often led to poor crop yield or massive crop failure [25,26]. For instance, the significant impact of crude oil spills on cassava production was observed [27] to include rotting tubers, stunted growth, poor yield, and crop failure.

Similarly, crude oil in the soil makes it unfavourable for the growth of plants [6], due to inadequate ventilation of the soil owing to the dislodgment of air spaces amongst soil particles due to the occurrence of crude oil contamination. Also, [28] revealed that most plants growing in a crude oil-polluted have soil chlorosis of leaves, generally retarded, and in addition to plant dehydration. Mostly, crude oil pollution often leads to reduced growth in plants because it inhibits the plant's nutrient uptake. It also engenders stiff competition among the plants for the existing little nutrients found in the contaminated soils within soil microbes and plants and eventually inhibits the plants growing in such soil.

Reflecting on the harmful impact of crude oil contamination on plants and its associated consequences for environmental integrity and food security in the oil-rich Niger Delta region, it is imperative to screen for plants with high tolerance levels and resistance to crude oil pollution. When such plants are found, it is important to plan to carry out phytoremediation practices in such oil-producing communities in the Niger Delta and where it is found to be safe for consumption, it will alleviate the crises associated with food security in the oil-rich region. *Mucuna pruriens* (Velvet bean) can be cultivated in conservation agriculture for the purpose of getting green manure, testing the fertility of the soil, and used as a cover crop. The velvet bean is a high-yielding leguminous forage crop that contains nitrogen (N) and crude protein content. It is typically propagated as a green manure crop, or an N-fixing ley crop aimed at improving fertility of the soil.

In tropical regions, to improve the fertility of the soil, the Velvet bean is usually intercropped with maize to maximise herbage/grain yields per unit area and enable mixed cropping to encourage silage/haymaking. Even if it is cultivated as a mixed or single crop, the velvet bean offers fodder for

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hay or early dry season grazing or mixed-crop silage to enhance the Nitrogen content of the grass or cereal silage. The silage and hay are used as added feed during the dry season to improve the digestion of poor-quality fibres, such as maize stover. Mucuna is a productive seeder, and its seed is 26% crude protein and can be used to replace commercial supplements in home-mixed rations.

Its grain is not beneficial to non-ruminant farm animals, but it is beneficial to humans for consumption after the reduction of the toxins by boiling and discarding the water several times. Mucuna is cultivated as a major food crop, and this study effectively monitored the process of germination and growth under hydrocarbon pollution as a model plant. It is done to feature the adverse impact of crude oil pollution principally on its sprouting and growth processes. This process enables stakeholders to make knowledgeable decisions on how to effectively prevent spills, and the protocols to avoid and minimise environmental, food, and social and economic crises in Nigeria. Host communities will be able to prepare against the impending dangers associated with the exploration of crude oil to the environment and sources of livelihood.

2. Materials and Methods

2.1. Study area

The location of this study was at the Botanic Garden, Department of Plant Science and Biotechnology, University of Port Harcourt starting from July 2023 to September 2023.

2.2. Collection of Seeds

All the Velvet bean seeds used for this study came from the International Institute of Tropical Agriculture (IITA) in Ibadan, Oyo state, Nigeria. The sample of the crude oil used was taken from the facility owned and managed by the Shell Petroleum Development Company of Nigeria Limited (SPDC) at their Aluu Flow Station. Other materials used include Petri dishes, a test tube, a bjour bottle, a pipette, a conical flask, an autoclave, a hot oven, a Bunsen burner flame, glass spreader, nutrient agar, potato dextrose agar, black planting bags (Area 594 cm^2), measuring cylinder, ruler, tape, transparent paper, graph sheet.

2.3. Viability Test

The viability test was performed by selecting thirty seeds of *Mucuna pruriens* and placing them in a petri dish lined with cotton wool. Six petri dishes were used and in each of the petri dishes, five seeds were placed, and the cotton wool was moistened with 30ml of distilled water.

2.4. Planting Exercise

In the experiment, a total of 45 planting bags were used with a surface area of 594cm^2. These planting bags were filled with the topsoil taken from the Botanical Garden of the University of Port Harcourt, Choba. All the planting bags were perforated to eliminate excess water. As such, only four seeds were planted in each bag.

2.5. Germination Count/Staking Exercise

After two weeks of planting, it was observed that nearly all the seeds germinated. *Mucuna pruriens* is an annual twining and creeping plant, therefore for accuracy, the stem was staked and tied with a twine.

2.6. Preparing different concentrations of crude oil and its applications.

To prepare the various concentrations of crude oil, the following dilutions were used; control, 100ml, 200ml, 400ml, 800ml and 1600ml respectively using a measuring cylinder calibrated in millilitres. A completely randomised design was employed. The topsoil was loosed gradually to enable the crude oil to get inside the sample pot without wastage.

2.7. Measurement parameters

2.7.1. Plant height

The height was measured using a straight rule from the surface of the soil to the terminal bud of the plant.

2.7.2. Number of leaves

The number of leaves for each plant was counted weekly as the plant height was measured and recorded at the same time.

2.7.3. Leaf Area

The area of the leaf was determined by tracing the shape of the leaf on transparent paper, thereafter the graph sheet was used to count the number of the centimeter square units (cm^2).

2.8. Collection of Soil, Experimental Design, Pollution Level and Layout

From the Botanical Garden of the Department of Plant Science and Biotechnology, University of Port Harcourt, thirty kilograms (30kg) of surface soil from (0 – 15cm) were added into the potted bags. As a completely randomised design with 6 treatments, and 8 replicates, it gave rise to 45 observations that were employed in the study. The treatments include

Treatment 1: No pollutant was introduced into the soil (Control).
Treatment 2: 100ml of PMS (Petrol);
Treatment 3: 200ml of PMS (Petrol);
Treatment 4: 400ml of PMS (Petrol);
Treatment 5: 800ml of PMS (Petrol);
Treatment 6: 1600ml of PMS (Petrol).

2.9. Method of the Experiment

All the 30kg of soil contained in the potted bags were polluted with varied levels of concentrations of the pollutants except for the control which had no pollutants in it. These pollutants were then left in the soil for about 2 weeks after which 5 velvet bean seeds were planted and thinned to 1 stand per bag after 2 weeks of planting.

2.10. Parameters

Soil physicochemical and morphological parameters were taken on the velvet bean plants and soil respectively. Morphological parameters such as leaf area, number of leaves and plant height were taken at intervals of 2 weeks, 4 weeks, 8 weeks, and 12 weeks post-planting. Soil physicochemical strictures include the conductivity of the soil, the pH level of the soil, soil Nitrogen, soil alkalinity, and Total Organic matter (Table 1).

Table 1. Physico/chemical analysis of the pollutant before planting.

Physio/chemical parameters/ Treatments	Nitrogen	Total Organic Matter (%)	pH	Conductivity (µS/cm)	Alkalinity (mg/kg)
Control	0.20	6.3	6.49	0.13	3.9
100ml	0.078	6.0	6.69	012	7.2
200ml	0.064	5.1	7.02	009	8.20
400ml	0.052	4.2	7.89	007	9.62
800ml	0.031	3.6	8.07	005	10.1
1600ml	0.011	2.9	9.69	004	11.4

Source: Authors, 2023.

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3. Data Analysis

The collected data were analysed using analysis of variance technique (ANOVA) determined at a 5% level of probability. The Means were also separated using the Least Significant Difference (LSD).

4. Result and Discussion

Test for Germinability: Thirty seeds of *Mucuna pruriens* were tested for viability. 100% germination was observed in the control bag with zero volume of crude oil after a lag phase of eight (8) days. The impact of the toxins contained in these pollutants on velvet bean plants was observed based on one plant density of the velvet bean plant by assessing the leaf area, number of leaves, heights of the plants, and dry and fresh weights which was compared with the control from planting to harvesting.

After the pollution of the pots with different concentrations of crude oil was done, it was observed that nearly all the pots were responding positively to normal plant increment. However, after two weeks of planting, the control had a significantly higher ($P \le 0.05$) than other treatments. Treatment 800ml and Treatment 1600ml had significantly lower ($P \le 0.05$) than other treatments (Table 2). Four weeks after the planting, all the velvet cultivated on polluted soil failed to perform well as compared to the plants in the control. Visual assessment also indicates that all the plants in the polluted bags had poor growth, while it was observed that plants grown on Treatment 400ml, Treatment 800ml and Treatment 1600ml polluted soil. Statistical indication in the heights of the plant indicates no significant differences ($P \le 0.05$) recorded between the treatments control, 800ml and 1600ml.

Table 2. Effect of the pollutant on Plant Height.

Treatment	Duration			
	2 weeks	4 weeks	8 weeks	12 weeks
Control	17.4	34.6	55.7	143.7
100ml	15.2	28.5	42.8	91.2
200ml	14.6	22.6	36.4	68.9
400ml	13.5	20.3	29.7	32.7
800ml	11.1	17.8	21.3	28.6
1600ml	10.2	15.4	17.5	17.5

Source: Authors, 2023.

However, these treatments had significantly higher ($P \le 0.05$) than other treatments. After Eight (8) weeks of planting, it was observed that the impact of the pollution had drastically reduced due to the recovery process of the plant. The non–polluted treatment, specifically the control had significantly higher ($P \le 0.05$) than other treatments. Treatment 400ml, Treatment 800ml and Treatment 1600ml had significantly lower ($P \le 0.05$) than the other treatments. Growth was retarded in Treatment 1600ml followed by discolouration. A similar observation was made for treatment 800ml at twelve weeks after planting. The soil surface showed a shiny surface with a dark outlook indicating crude oil coating on the surface. Furthermore, oil spills on the soil do not encourage the growth of plants [29], because of the deficiencies in the aeration of the soil and the massive displacement of air from the spaces between the soil particles by crude oil. [28] also reported that those plants growing on the polluted soil showed signs of chlorosis on leaves and general retardation in addition to the dehydration of plants indicating deficiency.

After the pot treatment exercise, the leaf numbers of the velvet bean increased significantly as the plant height increased. The number of leaves after two weeks of planting indicated a different interpretation in which treatment 100ml had significantly higher ($P \le 0.05$) than other treatments followed by treatment control and the other treatments were not significantly ($P \le 0.05$) different from each other (Table 3). At four weeks after planting several leaves were negatively affected by the treatments in which case treatments 400ml, 800ml and 1600ml were significantly ($P \le 0.05$) lower than treatments control. The number of leaves at eight weeks after planting indicated a different trend in which case treatments 800ml and 1600ml had significantly lower ($P \leq 0.05$) than the control.

Table 3. Effect of the pollutant on Number of Leaves.

Treatment	Duration			
	2 weeks	4 weeks	8 weeks	12 weeks
Control	5.2	25.6	60.7	89.9
100ml	6.1	18.9	31.3	35.3
200ml	5.0	16.2	22.7	25.7
400ml	4.7	13.4	16.8	18.1
800ml	4.2	11.3	11.2	11.3
1600ml	3.3	10.7	8.5	4.3

Source: Authors, 2023.

During these lag phases of growth, treatment 1600ml and 800ml respectively, increased stuntedness, chlorosis, tough apical meristems, and gradual leaf fall from the base of the plant. These effects led to the reduction of the number of leaves of the velvet bean. [30] asserts that the presence of crude oil degrading bacteria has been proven in Bonny light crude oil, gasoline, and kerosene. These organisms are more abundant in crude oil (ca. 2.93 x 105 cfu/ml) than in kerosene (ca 3.22 x 104 cfu/ml) and gasoline (ca. 2.96 x 104 cfu/ml). The growth of velvet beans would have been hindered because the relationship between the plant and the rhizosphere can be affected by petroleum [31].

Visually assessing all the plants grown in the pollutants indicates that the leaf area within the first two weeks had the same ratio. However, after four weeks of planting the leaf area indicates that the control had significantly higher ($P \leq 0.05$) than other treatments (Table 4). However, at the lag phase of the experiment, it was observed that there was no significant ($P \leq 0.05$) difference between the mean leaf area of different sets of replicates. The study showed that velvet beans have an equivalent leaf area.

Table 4. Effect of the pollutant on Leaf Area.

Treatment	Duration			
	2 weeks	4 weeks	8 weeks	12 weeks
Control	122.8	163.2	224.5	305.8
100ml	124.4	145.0	189.8	206.3
200ml	125.0	136.0	142.6	145.3
400ml	124.4	126.4	128.4	126.9
800ml	120.8	122.4	119.7	119.6
1600ml	122.4	122.9	102.2	92.8

Source: Authors, 2023.

Table 5. Analysis of variance of the effect of crude oil on plant height at 100% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	98382.56	24595.64	253.37	
Treatment	4	510.56	129.14	1.33	3.26
Variation	4	2662.96	665.74	6.85	
Error	12	1164.88	97.07		
Total	24	102727			

Source: Authors, 2023.

Table 6. Analysis of variance of the effect of crude oil on plant height at 200% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	40043.84	10010.96	98.37	
Treatment	4	220.24	55.06	0.54	3.36
Variation	4	5556.24	1389.06	13.65	
Error	12	1221.12	101.76		
Total	24	47041.46			

Source: Authors, 2023.

Table 7. Analysis of variance of the effect of crude oil on plant height at 400% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	3790.56	9492.64	177.41	
Treatment	4	827.76	206.94	3.86	3.26
Variation	4	3314.56	828.64	15.48	
Error	12	642.08	53.50		
Total	24	42754.96			

Source: Authors, 2023.

Table 8. Analysis of variance of the effect of crude oil on plant height at 800% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	3517.86	879.46	31.01	
Treatment	4	55.84	13.96	0.49	3.26
Variation	4	311.04	77.76	2.74	
Error	12	340.32	28.36		
Total	24	4225.04			

Source: Authors, 2023.

Table 9. Analysis of variance of the effect of crude oil on plant height at 1600% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	14222.24	3555.56	76.31	
Treatment	4	141.04	35.26	0.75	3.26
Variation	4	5073.84	1268.46	27.22	
Error	12	559.12	46.59		
Total	24	19996.24			

Source: Authors, 2023.

Table 10. Analysis of variance of the effect of crude oil on Number of leaves at 100% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	1616.16	404.04	177.73	
Treatment	4	2.96	0.74	0.32	3.26
Variation	4	41.36	10.34	4.54	
Error	12	27.28	2.27		
Total	24	1687.76			

Source: Authors, 2023.

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Table 11. Analysis of variance of the effect of crude oil on Number of leaves at 200% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	1111.36	277.84	39.46	
Treatment	4	5.36	1.34	0.19	3.26
Variation	4	32.96	8.24	1.17	
Error	12	84.48	7.04		
Total	24	1234.16			

Source: Authors, 2023.

Table 12. Analysis of variance of the effect of crude oil on Number of leaves at 400% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	1016.16	254.04	87.39	
Treatment	4	20.16	5.04	1.73	3.26
Variation	4	22.56	5.64	1.94	
Error	12	34.88	2.90		
Total	24	1093.76			

Source: Authors, 2023.

Table 13. Analysis of variance of the effect of crude oil on Number of leaves at 800% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	427.44	106.86	8.37	
Treatment	4	35.04	8.78	0.66	3.26
Variation	4	82.64	20.66	1.61	
Error	12	153.12	12.76		
Total	24	696.24			

Source: Authors, 2023.

Table 14. Analysis of variance of the effect of crude oil on Number of leaves at 1600% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	402.8	100.7	20.55	
Treatment	4	39.2	9.8	2.00	3.26
Variation	4	61.2	15.3	3.12	
Error	12	58.8	4.9		
Total	24	562.0			

Source: Authors, 2023.

Table 15. Analysis of variance of the effect of crude oil on Leave Area at 100% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	3797.36	949.34	200.28	
Treatment	4	20.96	5.24	1.10	3.26
Variation	4	194.16	48.54	10.24	

Error	12	56.88	4.74		
Total	24	4009.36			

Source: Authors, 2023.

Table 16. Analysis of variance of the effect of crude oil on Leave Area at 200% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	4062.64	1015.66	154.82	
Treatment	4	17.84	4.46	0.67	3.26
Variation	4	303.04	75.78	11.54	
Error	12	76.72	6.56		
Total	24	4462.24			

Source: Authors, 2023.

Table 17. Analysis of variance of the effect of crude oil on Leave Area at 400% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	3073.36	768.34	43.47	
Treatment	4	51.76	12.94	0.73	3.26
Variation	4	45.96	11.74	0.66	
Error	12	212.06	17.67		
Total	24	38.64.16			

Source: Authors, 2023.

Table 18. Analysis of variance of the effect of crude oil on Leave Area at 800% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	26425.04	6606.26	180.36	
Treatment	4	207.44	51.86	1.41	3.26
Variation	4	4467.44	1116.86	39.49	
Error	12	439.52	36.62		
Total	24	31539.44			

Source: Authors, 2023.

Table 19. Analysis of variance of the effect of crude oil on Leave Area at 1600% concentration of crude oil.

Source of variation	Degree of freedom	Sum of square	Mean square	F-Ration	F. Prob.
Blocks	4	3115.44	778.86	28.78	
Treatment	4	73.04	18.26	0.67	3.26
Variation	4	161.04	40.16	1.48	
Error	12	324.72	27.06		
Total	24	3674.24			

Source: Authors, 2023.

5. Planning implications of crude oil pollution

Globally, crude oil serves as the livewire of most developing and developed countries. With its critical importance in economic development, there have been rising cases of varying environmental and health challenges such as skin rashes, asthma and bronchitis, premature deaths, and cancer occasioned by the effects of crude oil pollution [32]. These actions represent a fallout of the underground movement and subsequent seepage of crude oil contaminants into the soil and contiguous waterbodies within the study area. It has resulted in a systemic distortion of the livelihood chain and ecosystem imbalance since most of the residents are engaged in artisanal fishing and subsistence farming. For instance, crude oil pollution has greatly impacted negatively on fish catch, crop yield, and other streams of income that sustain the economy of the locality. Fishing activities are carried out by a few of the residents due to the nature of the terrain as it does not encourage large-scale fishing. With the continuous crude oil contamination, the aquatic habitat and the entire bionetwork have become uninhabitable as available fish stocks are forced to migrate to safer grounds to breed [33].

Implicitly, the consequences of crude oil pollution on the study area and other adjoining farmlands and river bodies exert pressure on the existing public goods and services, especially health services as residents tend to fall ill frequently due to the continuous consumption of contaminated plants and animals. Besides, there is a phenomenal decline in crop yields and fish catch leading to increased dependency on the government and other corporate bodies for aid and grants to survive.

6. Conclusion

The impact of crude oil contamination was visible on the leaves and vines of velvet beans put in the different treatment concentrations of contaminants. The retard or stunted growth observed in the pots with concentrations of crude oil treatment 800mls and 1600mls and consequently longer lag phase preceding growth may perhaps be ascribed predominantly to the physical limitations as well as biological damage on the roots. [34] stated that the first process in germination and growth is the imbibition of water. The slower rate of imbibition was due to the hydrophobic property of crude oil on the roots considering the quantity present in the sample. The persistent oil film everywhere within the roots becomes a physical restraint and prevents or reduces both oxygen and water uptake which in turn adversely affects any gaseous exchange. Besides, the longer the period of presoaking in the crude oil, the more pronounced the inhibitory effect on the plant. Therefore, the percentage of growth and the consequential lag phase were depressed with time. This becomes possible since the rate of penetration and damage due to crude oil is dependent on the timing, nature and extent of the pollution [35–37].

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