4	0.6a ± 0.03	12.4a ± 0.6	16.9 ± 0.8	77.8 ± 17.5
6	0.5a ± 0.05	10.5a ± 0.95	13.98 ± 1.5	55.5 ± 16.2
8	0.6ac ± 0.03	12.9ac ± 0.6	17.5 ± 0.9	69.9 ± 17.2
10	0.5a ± 0.06	10.0a ± 1.2	13.6 ± 1.7	51.3 ± 13.0

Effect different dilutions of heavy crude oil on the means of Germination Rate (GR), Mean Daily Germination (MDG), Mean Germination Time (MGT) and Germination Index (GI) of Triticum aestivum L.

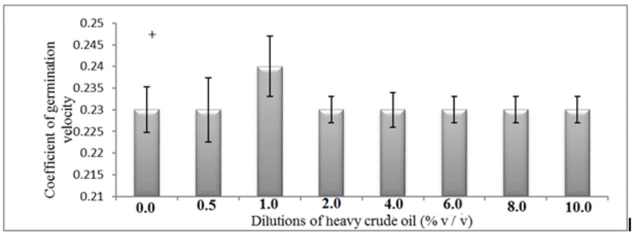

Figure 3: Effect of different dilutions of heavy crude oil on Coefficient of Germination Velocity (CGV) of Triticum aestivum L. (Wheat) seeds.

Treatment (%)	Mean values			
	Shoot length (cm)	Root length (cm)	Shoot fresh weight (g)	Root fresh weight (g)
0	+8.4 ± 1.8	*6.6a ± 1.4	+0.05 ± 0.01	*0.03a ± 0.007
0.5	8.4 ± 1.7	8.2ab ± 1.6	0.05 ± 0.01	0.06ab ± 0.01
1	10.3 ± 1.96	8.2ab ± 1.6	0.06 ± 0.01	0.05ab ± 0.009
2	11.3 ± 1.7	9.9ab ± 1.4	0.09 ± 0.01	0.07ab ± 0.01
4	12.2 ± 1.4	13.5b ± 1.5	0.08 ± 0.009	0.08b ± 0.009
6	10.9 ± 1.9	9.6ab ± 1.6	0.06 ± 0.01	0.05ab ± 0.009
8	12.8 ± 1.6	12.5ab ± 1.5	0.09 ± 0.01	0.07ab ± 0.009
10	10.6 ± 1.7	9.10ab ± 1.4	0.08 ± 0.02	0.05ab ± 0.01

Table 3: Effect of different dilutions of heavy crude oil on length shoots, roots (cm) and fresh weight (g) shoots, roots of Triticum aestivum L. (Wheat) seedlings.

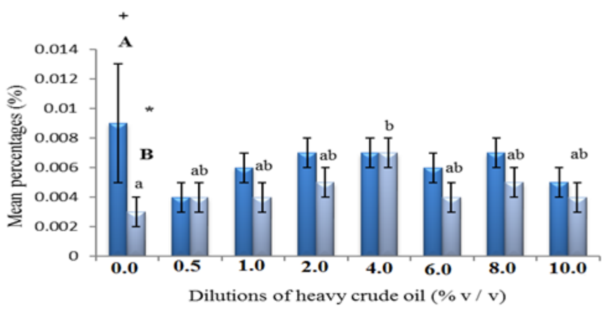

Figure 4: Effect of different dilutions of heavy crude oil on means of dry weight (g) shoots (A) and roots (B) of Triticum aestivum L. (Wheat) seedlings.

Treatment (%)	Mean values			
	Shoot dry weight (g)	Root dry weight (g)	Root / shoot	Relative water content (%)
0	0.009 ± 0.004	0.003a ± 0.001	0.60 ± 0.20	43.9 ± 8.3
0.5	0.004 ± 0.001	0.004ab ± 0.001	0.60 ± 0.10	49.1 ± 8.5
1	0.006 ± 0.001	0.004ab ± 0.001	0.30 ± 0.07	45.5 ± 8.5
2	0.007 ± 0.001	0.005ab ± 0.001	0.70 ± 0.10	64.6 ± 7.9
4	0.007 ± 0.001	0.007b ± 0.001	0.80 ± 0.097	70.0 ± 7.2
6	0.006 ± 0.001	0.004ab ± 0.001	0.50 ± 0.097	53.9 ± 8.2
8	0.007 ± 0.001	0.005ab ± 0.001	0.70± 0.10	70.1 ± 7.2
10	0.005 ± 0.001	0.004ab ± 0.001	0.50 ± 0.09	61.2 ± 8.0

Effect of different dilutions of heavy crude oil on the means of dry weight (g) of shoots and roots, root/shoot ratio and Relative Water Content (RWC%) of Triticum aestivum L. (Wheat) seedlings.

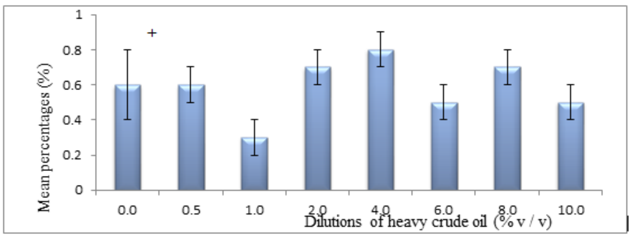

Figure 5: Effect of different dilutions of heavy crude oil on means of root / shoot ratio of Triticum aestivum L. (Wheat) seedlings.

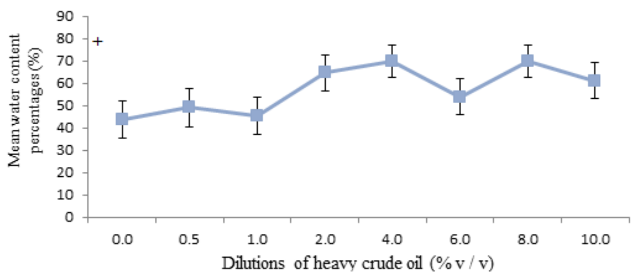

Figure 6: Effect of different dilutions of heavy crude oil on relative water contents percentages (%) of Triticum aestivum L. (Wheat) seedlings.

Treatment (%)	Mean values			
	Length (cm)	Fresh weight (g)	Dry weight (g)	Grade of growth

				inhibition index
0	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00	0.00 ± 0.00
0.5	15.6 ± 7.60	19.8 ± 8.10	-18.0 ± 29.0	18.0 ± 29.0
1	18.04 ± 8.20	17.5 ± 8.80	-4.5 ± 23.9	4.5 ± 23.9
2	22.7 ± 8.60	32.6 ± 7.60	1.0 ± 23.0	-1.0 ± 23.0
4.0	32.6 ± 8.50	31.96 ± 9.30	6.5 ± 25.2	-6.5 ± 25.2
6.0	17.96 ± 9.70	4.80 ± 17.6	-9.4 ± 37.8	9.4 ± 37.8
8	31.03 ± 9.50	33.0 ± 9.80	10.2 ± 19.6	-10.2 ± 19.6
10.0	19.8 ± 10.5	11.8 ± 17.2	-21.5 ± 50.0	21.5 ± 50.0

Table 5: Effect of different dilutions of heavy crude oil on the mean values of seedling growth inhibition percentages (%) and Grade of Growth Inhibition Index (GGI) of Triticum aestivum L. (Wheat) seedlings.

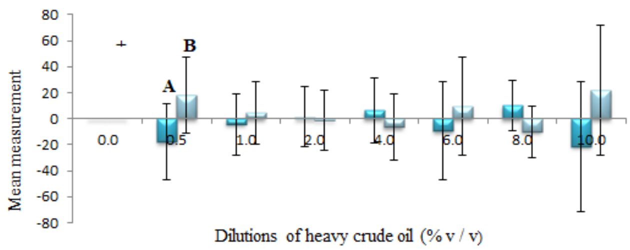

Figure 7: Effect of different dilutions of heavy crude oil on inhibition percentages (%) of dry weight (g) (A) and Grade of Growth Inhibition Index (GGI) (B) of Triticum aestivum L. (Wheat) seedlings.

Treatment (%)	Mean values		
	SE %	SVI	TI
0	+	+	+
	10.0 ± 1.9	299 ± 61.0	0.50 ± 0.09
0.5	10.7 ± 1.9	332.1 ± 64.0	0.50 ± 0.10
1	10.0 ± 1.9	370.5 ± 71.0	0.40 ± 0.10
2	14.0 ± 1.7	423.3 ± 59.5	0.60 ± 0.10
4	15.3 ± 1.6	515 ± 54.4	0.70 ± 0.10
6	12.0 ± 1.8	410 ± 68.0	0.50 ± 0.10
8	15.3 ± 1.6	505.7 ± 61.2	0.60 ± 0.10
10	13.3 ± 1.8	367.7 ± 61.0	0.50 ± 0.10

Table 6: Effect of different dilutions of heavy crude oil on Seedling Emergence (SE%), Seedling Vigor (SVI) and Tolerance Indices (TI) of Triticum aestivum L. (Wheat) seedlings.

For some seed parameters of some weeds which include Solanum nigrum, and some cultivated plants such as Triticum aestivum seeds. These parameters of Solanum nigrum and Triticum aestivum were promoted by different dilutions of types of crude oil. These results are agreed with the findings reported [22] who found that germination index of Indian mustard was not affect with diesel oil contaminated soil. Grasses germinated successfully in different levels of petroleum hydrocarbon contamination. The effect of phenol and naphthol compounds, as water soluble fractions of crude oil, on the germination and seedling development was investigated for seeds of some crops cultivated in Libya [23,24]. The obtained results showed that, low concentrations of both phenol and naphthol caused an increase of germination percentages of most seeds of tested crops. This is probably due to that, low dilutions of these compounds may act as signal for α- amylase production in the seeds [24]. These results agreed with those obtained [25] who found that low dilutions of naphtol had a promoting effect on rate and final germination of oat seeds. This was probably caused by strong resistant qualities of the black nightshade and wheat seeds. This high quality of resistance marks the foregoing species to be considered as promising candidates for the phytoremediation of sites crude polluted with petroleum oil. The study underscores the need for the use of cheap and available, and environmental friendly technology as a remedy for the harmful effects of petroleum contaminants in the environment. In general, seed germination of all target species used in this work was enhanced under the stimulation of heavy crude oil. This is might be due to the hydrophopicity of heavy oil which possesses less solubility in water and therefore causes phytotoxicity. Most studies of the effects of crude oil have examined the effect of petroleum residues on physiological parameters such as percentages of seed germination of corn, okra, soybeans and Amaranths hybridus where their germination was delayed in the soil polluted by crude oil [3,13]. Generally, contamination by petroleum hydrocarbon causes retardation of seed germination [26] that led to adverse biological effects of some plant species. Some researchers have considered naphthalene as a more important source of crude oil toxicity than low molecular weight aromatics [23,25]. Shoot growth retardation in plants due to petroleum pollution as observed in this work had been reported by different workers on related studies [26-32]. During their study with three vascular plants (fluted pumpkin, maize and okra) reported retardation in their shoot growth as a result of crude oil contamination. Seedling performance of plants used in this study was measured under different dilutions of different type of oil compound. Generally, the highest performance in terms of percentage emergence and seedling development was recorded in black nightshade and wheat. It seems to the present study that the adverse effect noticed on the treated never-fading flower and corn plants may be due to unfavorable germination conditions created by toxic substances contained in the crude oil. Growth reduction in crude oil polluted media as observed in this study for some plant species may also be attributed to a disruption in aeration. This observation is in line with the findings reported delayed germination and reduction in grain yield of maize in crude oil polluted soil [3,33-40]. This study indicates that wheat have more potential for resistance of crude oil concentrations and that can be used as promising tools for phytoremediation technology. It is apparent from the discussions that the following conclusions can be made. The influence of heavy crude oil upon different target plant species used in this research was not clearly pronounced (different) i.e., all plant species were not affected by the applications of heavy crude oil residues. This might be due to that heavy oil is more viscous and less soluble in water.

SUMMARY

The effected of heavy crude oil was examined for seed germination and seedling performance in the case of seed measures of Triticum aestivum L. (Wheat) were enhanced under. Whereas, they were promoted heavy crude oil. Furthermore, seedling performance was noticed to be good of Triticum aestivum under type of oil. Based on the obtained results the following conclusions can be summarized. This study indicates is wheat having more potential for resistance of crude oil concentrations and they can be used as promising tools for phytoremediation technology

REFERENCES

1. Soyingbe, A.A., et al., (2007) Effect of lead polution on the performance and protein content of two soybean varieties. Res J Agro 1:26-29.
2. Bamidele, J.F., (2010) Threats to sustainable utilization of coastal wetlands in Nigeria. J. Nig. Environ. Soc. 5:217-225.
3. Debojit B, Jitu. B., and Sarada, K.S., (2011) Impact of Assam petroleum crude oil on the germination of four crude oil-resistant species. Asian J. Plant Sci. Res 1:68-76.
4. Njoku, K.L., Akinola MO, and Busari TO (2012) Effect of time of application of spent oil on the growth and performance of maize (Zea mays). African J Environ Sci Technolol 6:67-71.
5. Achuba, F.I., and Peretiemo, B.O., (2007) Effect of spent oil on soil catalase and dehydrogenase activities. Int Agrophy 22:1-4.
6. Edema, N., (2012) Effects of crude oil contaminated water on the environment. Manar El-Sayed Abdul-Raouf Ed. In Tech Open Access Company 9:170-180.
7. Njoku, K.L., Akinola, M.O., and Taiwo, B.G., (2009). Effect of gasoline diesel fuel mixture on the germination and the growth of Vigna unguiculata (Cowpea). African J of Environ Sci Technol 12:466-471.
8. Agbogidi, M.O., (2011a). Susceptibility of five cultivars of Soya bean (Glycine max) (L Merr) seeds to spent engine oil. Int. J. Sci. Nature. 2, pp. 447-451.
9. Sharifi, M., Sadeghi, Y., and Akbarpour, M., (2007). Germination and growth of six plant species on contaminated soil with spent oil. Int. J. Environ. Sci. Tech 4, pp. 463-470.
10. Ekundayo, E.O., Emede, T.O., and Osayande, D.I., (2001). Effects of crude oil spillage on growth and yield of maize (Zea mays L.) in soils of midwestern Nigeria. Plant Foods Hum. Nutr 56, pp. 313-324.
11. Adenipekun, C.O., Oyetunji, O.J., and Kassim, L.Q., (2009). Screening of Abelmoschus esculentus L. Moench for tolerance to spent engine. J App. Biosci 20, pp. 1131-1137.
12. Agbogidi, O.M., and Eshegbeyi, O.F., (2006). Performance of Dacryodes edulis (Don. G. Lam H.J.) seeds and seedlings in a crude oil contaminated soil. J. Sustainable For 22, pp. 1-14.
13. Agbogidi, O.M., and Edema, N.E., (2013). Effects of spent engine oil on the germination and seedling growth of Moringa oleifera (Lam.) J. Agric. Sci 5, pp. 205-209.
14. Pezeshki, S.R., et al., (2000). The effects of oil spill and clean-up on dominant US gulf coast marsh macrophtes (Review). Environ Pollution 108, pp. 129-139.
15. Streche, C., et al., (2018). Decontamination of petroleum-contaminated soils using the electrochemical technique: remediation degree and energy consumption. Sci rep.
16. Merkl, N., Schultze, K.R., and Infante, C., (2004). Phytoremediation in the tropics. The effect of crude oil on the growth of tropical plants. Bioremed J. 8, pp. 177-184.
17. Luhach, J., and Chaudhry, S., (2012). Effect of diesel fuel contamination on seed germination and growth of four agricultural crops. Afr. J. Biotechnol 4:311-317.
18. Kelechi, L.N., Moduje, S.A., and Temitope, O.B., (2012). Effect of time of application of spent oil on the growth and performance of maize (Zea mays). Afr. J. Environ. Sci. Technol 1, pp. 67-71.
19. Odjegba, V.J., and Atebe, J.O., (2007). The Effectof used engine oil on carbohydrate, mineral contentandNitrate reductase activity of leafy vegetable (Amaranthus Hybridus L.). J App Sci and Enviro Mang 11, pp. 191-196.
20. Kayode, O., Olowoyo, A., and Oyedeji., (2009). The Effects of used engine oil pollution on the growth and early seedling performance of vigna uniguiculata and Zea mays. Res Jour Soil Bio 1, pp. 15-19.
21. Adam, G., and Duncan, H., (2002). Influence of diesel fuel on seed germination. Environmental Pollution 120, pp. 363-370.
22. Sharifi, M., Sadeghi, Y., and Akbarpour, M., (2007). Germination and growth of six plant species on contaminated soil with spent oil. Int J Environ Sci Tech 4, pp. 463-470.
23. Malek, Hossein, S., and Gholamreza, S., (2007). Study of growth and germination of Medicago sativa (Alfalfa) in light crude oil contaminated soil. Res J Agric Biol Sci 1, pp. 46-51.
24. Kyung, B.H., et al., (2004). Effects of crude oil, oil components and bioremediation on plant. J environ health sci 9, pp. 2465-2472.
25. Omosun, G., Markson, A.A., and Mbanasor, O., (2008). Growth and anatomy of Amaranthus Hybridus as affected by diferrent crude oil concentrations . American-Eurasian J of Sci Res 1, pp. 70-74.
26. Eriyamremu, G.E., et al., (2007). Bonny light crude oil and its fractions alter radicle galactose dehydrogenase activity of beans (Phaseolus vulgaris L.) and maize (Zea mays). Trends in Appl Sci Res 2, pp. 433-438.
27. Kekere, O., Ikhajiagbe, B., and Apela, B.R., (2011). Effects of crude petroleum oil on the germination, growth and yield of Vigna Unguiculata walp L. J Agri Bio Sci 6, pp. 158-165.
28. Lin, Q., and Mendelsshohn, I.A., (2009). Potential of restoration and phytoremediation with Juncus roemerianus for diesel-contaminated coastal wetlands. Ecol. Eng 35, pp. 85-91.
29. Bamidele, J.F., and Igiri, A., (2011). Growth of seashore paspalum (Paspalum vaginatum) in soil contaminated with crude petroleum oil. J Appl Sci Environ Manage 15, pp. 303-306.
30. Ogbo, E.M., (2009). Effects of diesel fuel contamination on seed germination of four crop plants-Arachis hypogaea,Vigna unguiculata, Sorghum bicolor and Zea mays. African J Biotechn 8, pp. 250-253.
31. Obi, J.C., Ogunkunle, A.O., and Meludu, N.T., (2008). Effect of termite infestation on the farming system and characteristics of an endemic area in the guinea savanna region of Nigeria. Am Eurasian J Sci Res 3, pp. 1-6.

32. Anoliefo, G.O., and Edegbai, B.O., (2001). Effect of crude oil as a soil contaminant on the growth of two egg plant species, Solanum melongena L. and S. incanum. J Agricu Forestry and Fisheries 1:1-25.

33. Victor, J.O., Sadiq, A.O., (2002). Effects of spent engine oil on the growth parameters chlorophyll and protein levels of Amaranthus hybridus L. J Environ 22, pp. 23-28.

34. Daniel, K.L.A., Pepple, S.F., (2006). Effect of bonny light crude oil pollution of soil on the growth of dayflower (Commelina benghalensis L.) in the Niger Delta, Nigeria. J Appl Sci Environ Mgt 10, pp. 111-114.

35. Spiares, J.D.E., Kenwrthy, K., and Rhykerd, R., (2001), Emegence and height of plants seeded in crude oil cont aminated Soil, Texas. J of Agric Natu Re-sources 14, pp. 37-46.

36. Anoliefo, G.O., and Edegbai, B.O., (2000). Effects of spent oil as oil contaminant on the growth of two eggplant species Solanium melongene and S. incanum. J Agric For Fish 1, pp. 21-25.

37. Ikhajiagbe, B., and Anoliefo, G.O., (2011). Natural attenuation of a 14-month-old waste engine oil polluted soil. J Soil Sci Environ Manage 7, pp. 184-192.

38. Wioko, V.D.E., and Fashemi, D.S., (2005). Growth response of Ricinus cummunis L. (castor oil) in spent lubricating oil polluted soil. J Applied Sci Environ Manage 2, pp. 73-79.

39. Odjegba, V.J., and Sadiq, A.O., (2002). Effects of spent engine oil on the growth parameters, chlorophyll and protein levels of Amaranthus hybridus L. Environ 22, pp. 23-28.

40. Agbogidi, O.M., Eruotor, P.G., and Akparobi, S.O., (2007). Effects of time of application of crude oil to soil on the growth of maize (Zea mays L.). Res J Environ Toxicol 1, pp. 116-123.