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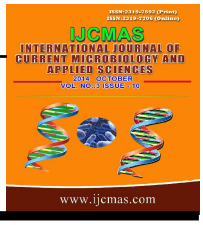

Original Research Article

Effect of crude oil pollution on orange (Citrus) leaves

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A B S T R A C T

Evaluation of proximate composition of some edible citrus trees grown in an oil producing community (Eleme) of River State, Nigeria was investigated. The trees were *Citrus sinensis* (orange) leaves, proximate analysis of test crude oil polluted *Citrus sinensis* leaves and unpolluted *Citrus sinensis* leaves and were analysed repeatedly during the interval of week 0, week 1 and week 2. The result revealed significant variation in percentage content of the polluted *Citrus sinensis* leave sample and unpolluted *Citrus sinensis* leave sample. Figures 1 to 6 showed a decrease in percentage parameter for crude oil polluted *Citrus sinensis*: percentage moisture (45.20 and 48.60%), percentage carbohydrate citrus (13.98 and 14.59%), percentage protein (3.80 and 3.65%), and percentage lipids (0.80 and 1.05%) respectively lower than the unpolluted *Citrus sinensis* leave sample. The decrease in the cell components induced chlorosis, necrosis and early leaf abscission, affecting decrease in net photosynthesis productivity, reduction in growth and yield of citrus fruits crop, reduction in seed germination, decrease survival percentage, crop height, seedling height, and stem girth, number of leaves and leaf area and chlorophyll content.

Keywords

Citrus Sinensis, Crude Oil Pollution, Unpolluted citrus leaves, Proximate Composition and Bioremediation

Introduction

The problem of crude oil pollution has become one of the most controversial issues in the Niger Delta oil industry in recent time.

The oil industry by nature is a potential massive pollution in Horticulture crops activities in Rivers state by the oil companies. Crude oil (petroleum) is a

complex mixture of hydrocarbons that form from the partial decomposition of biogenic materials. It is the largest and most important source of hydrocarbons (Hunt, 1996) and it varies in appearance and composition from one oil kind to another (Craig, 2003). Crude oil when distilled yields a great variety of products which include petrol, kerosene, diesel etc. The threat to the natural environment caused by oil product due to land disposal of waste, leakage from storage tanks and pipeline during distribution process as well as by car and railway transport and petrol station is rapidly increasing (Michalewiez, 1995 andZienko,1996). Crude oil not only modifies the physic-chemical properties (Tyezkowski,1993) and biological properties of the soil (Ola czuk-Neyman et al., 1994; Lebskowka et al., 1995) but also contribute to limitation of the productive ability of arable crops and potentially dangerous for animals and human health (Wyozkowka and Kucharski, 2000). The emergence of crude oil industries has contributed immensely to changing the state of Nigerian economy and the environment. The oil industry is a major source of environmental pollution and its adverse ecological impacts have been reported (Ibia et al., 2002; Ekpo and Thomas, 2007). This is widely spread with specifically more serious damage on the oil producing areas. The most obvious area which has generated a lot of concern is spillage resulting from oil well blowout or pipeline leakage with each major spill incident increasing the vulnerability of our fragile environment (Ibe, Ekpo and Nwankpa 2000). Crude oil exploration has effect both positive and negative on the Niger Delta region, which in turn has created condition in the Niger Delta region. One of those conditions is the crude oil pollution on horticultural crops (citric fruits precisely) in River State.

Citrus fruits, which belong to the family of Rutaceae are one of the main fruit tree crops grown throughout the world. Although sweet orange (Citrus sinensis) is the major fruit in this group. The group also encompasses small citrus fruits such as tangerine tree (Citrus reticulata), grapefruit tree (Citrus vitis), lime tree (Citrus aurantifulia) and lemon tree (Citrus limonum). Citric fruits are natural staple food of man containing essential nutrients in adequate proportion. Oil spillage is a global issue that has been occurring since the discovery of crude oil, which was part of the industrial revolution. The total spillage of petroleum into the oceans, seas and rivers through human activities is estimated to range 0.7 1.7 million tons per year. Oil spills have passed a major threat to the environment of the oil producing areas, which if not effectively checked can lead to the total destruction of ecosystems (Kadafa, 2012). Nigeria is a major petroleum producing country. One drastic effect associated with the exploration and exploitation is the contamination of the immediate environment with petroleum hydrocarbons (Amadi et al., 1993). Most of the land in an oil producing areas in Nigeria is cultivated because the mainstay of people living in the region are farming and fishing (Onwurah et al., 2007). This may result in contamination of agricultural produce and its contaminants shift in productivity dynamics, contamination of soil arising from spills is one of the most limiting factors to soil fertility and hence crop productivity (Otitoju and Onwurah, 2010). Considerable changes in soil properties usually occur when a soil is polluted by an oil spill. These changes include the water-holding capacity of the soil, loss of soil structure, introduction of anaerobic conditions and reduction in activities of aerobic microorganisms and fauna such as earthworms (Mutters et

al., 2006). These changes affect crops growth and yield in the oil spill environment, the petroleum hydrocarbon reduces the nutrient bioavailability as well as water availability to plants

Crude oil spill on land, particularly agricultural soil can cause a serious damage by affecting both the biophysical and biochemical properties of the soil (Otitoju et al., 2010). Crude oil spillage on soils reduces aeration by blocking air spaces between soil particles hence create conditions of anaerobiosis (Rowell, 1977) and reduction in activities of aerobic microorganisms and fauna such as earthworms (Mutters et al., 2006). Oil pollution has been reported to create some conditions in the soils, which make some essential minerals unavailable to plants and make some non-essential ones either readily available or cause them to rise to toxic level (Siddiqui and Adams, 2002). Atuanya (1987), Benka Coker and Ekundayo (1995) reported that oil pollution tends to change the physical, biological and chemical properties of soil thus, affecting crops growth and subsequent yields. Crude oil pollution leads to deterioration of soil structure, loss of organic matter contents, loss of soil mineral nutrients such as potassium, sodium, calcium, magnesium, nitrogen, sulphate, phosphate and nitrate. It also exposes soil to leaching and erosion. The activities of soil enzymes such as dehydrogenase, oxidase, lipases, urease and alkaline phosphatase have been shown to be reduced or inhibited in crude oil contaminated soils (Achuba, 2008).

Materials and Methods

The study location was in Eleme community, located east of Port Harcourt in Rivers state, Nigeria. The sample: Citrus sinensis leaves used for this research were collected in two ways; the contaminated citrus leaves sample were collected from a crude oil contaminated land from Eleme town and non-contaminated citrus leaves sample were collected from a farm land in a non-contaminated area in Eleme community. The leaves samples were detached from the stem and thoroughly washed with tap water to remove sand and crushed to homogenize using clean mortar and pestle, the grounded samples were stored in a labelled air tight container and kept in the refrigerator at 400C and used immediately for subsequent analysis. The analysis was repeated for the zero week, week 1 and week 2 respectively. The percentage moisture content was determined using air oven method. 1 gram of the sample weighed into a clean dried porcelain evaporating dish. This was placed in an oven to maintain a temperature of 105oC for six hours. The evaporating dish was cooled in desiccators to room temperature then it was re-weighed and recorded. The percentage protein content was determined using Kjeldahl method; the percentage of ash content was estimated using Furnace method, the percentage carbohydrate content was determined using Cleg Anthrone method, the percentage lipid content was determined using Soxhlet Extraction method and the percentage fibre content was determined by subtracting the summation up percentage composition of moisture, protein, lipid, carbohydrate, and ash contents from 100.

Results and Discussion

The effect of crude oil pollution on some selected citrus trees grown in an oil producing community, evaluation of proximate composition were observed in parameter of crude oil polluted environment and unpolluted environment (control).

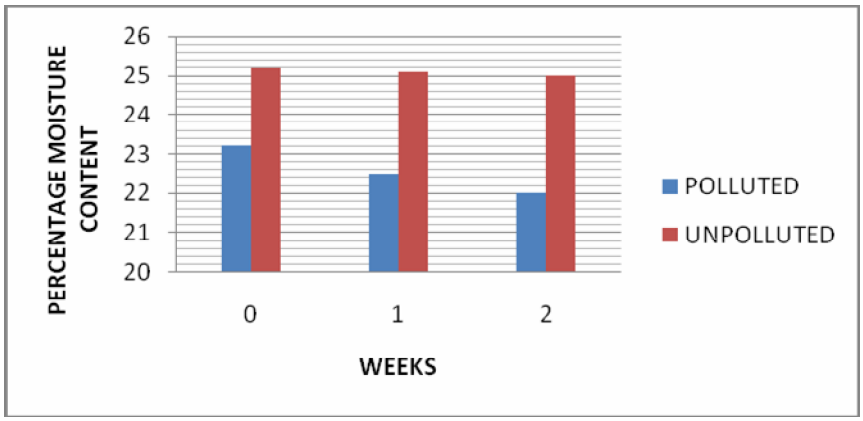

Figure.1 Effect of crude oil pollution on the percentage moisture content

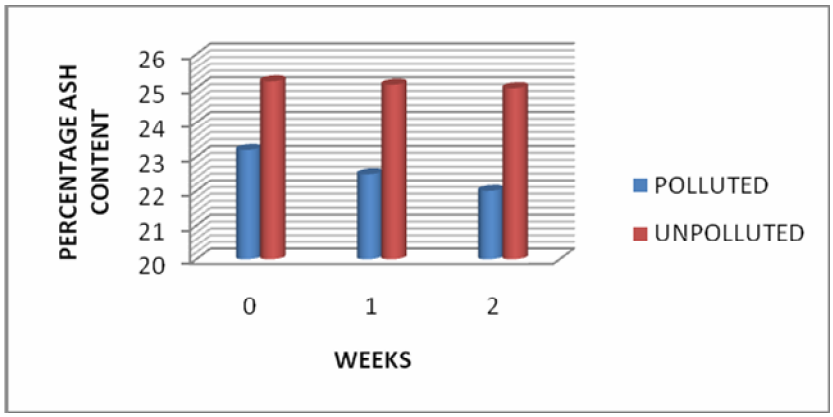

Figure.2 Effect of crude oil pollution on the percentage ash content

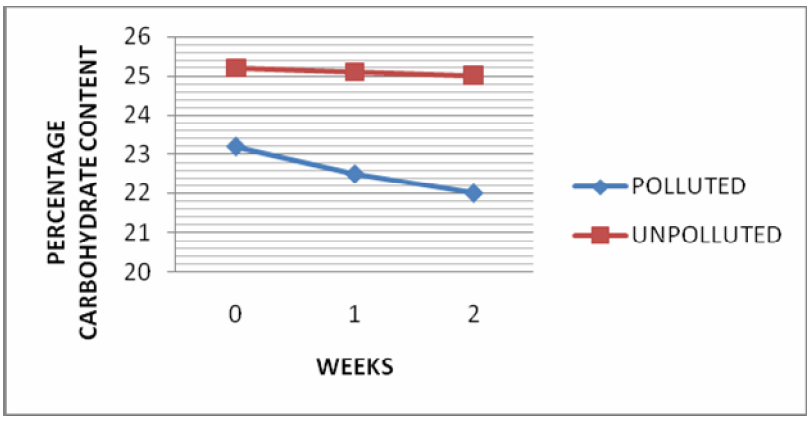

Figure.3 Effect of crude oil pollution on the percentage carbohydrate content

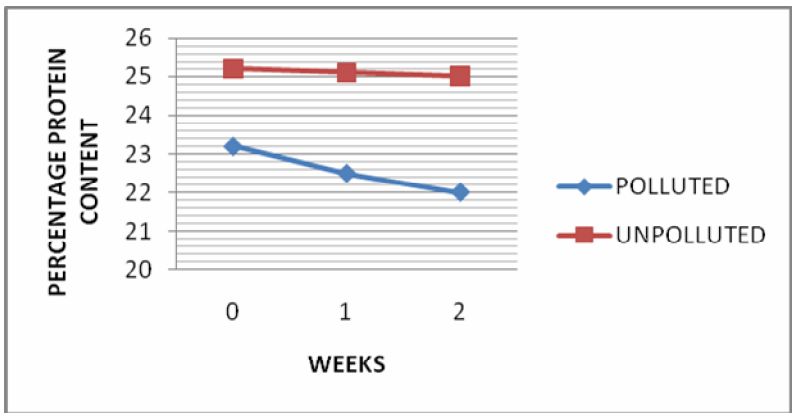

Figure.4 Effect of crude oil pollution on the percentage protein content

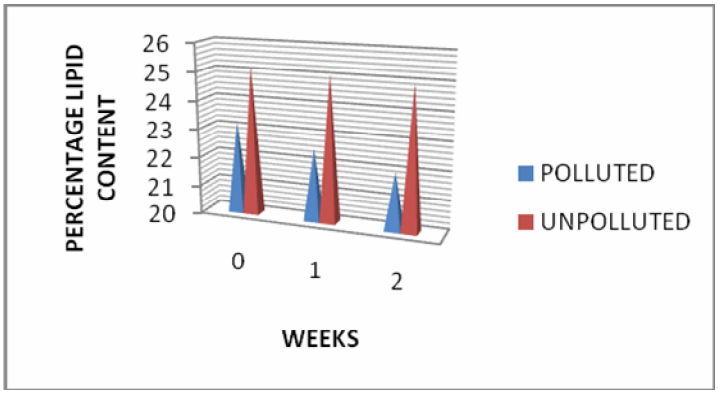

Figure.5 Effect of crude oil pollution on the percentage lipid content

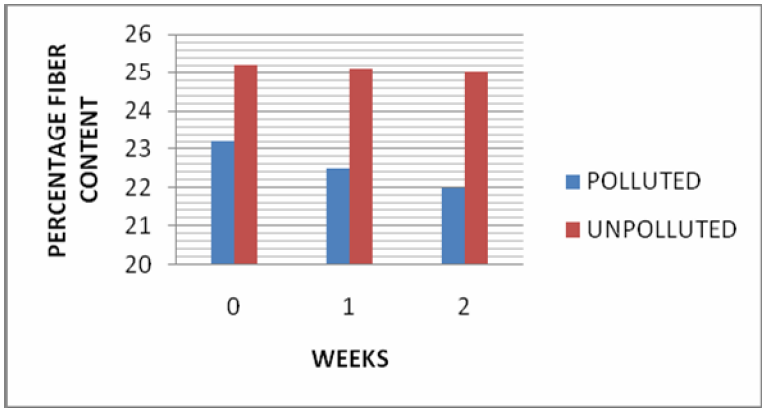

Figure.6 Effect of crude oil pollution on the percentage fibre content

The results revealed highly significant variation between unpolluted and polluted *Citrus sinensis* leaves. The proximate compositions include moisture content (fig. 1), ash content (fig. 2), carbohydrate content (fig.3), protein content (fig. 4), lipid content (fig. 5) and fibre content (fig. 6). The polluted *Citrus sinensis* leaves sample showed a significant decrease in percentage for moisture, protein, lipid, carbohydrate content than the unpolluted *Citrus sinensis* leave sample. These reductions induced a negative effect on the production and yield of citrus trees. Therefore *Citrus sinensis* leaves grown in crude oil polluted soil under observation performed poorly by adversely affecting the growth and yield, reduction in seed germination, decrease survival percentage, crop height, seedling height, stem girth, number of leaves and leaf area. The determination of proximate composition were done during the intervals of week 0, and repeated for week 1 and week 2.

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