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EFFECTS OF SPENT MOTOR OIL ON SOIL PHYSICO-CHEMICAL PROPERTIES AND GROWTH OF *ARACHIS HYPOGAEA* L.

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ABSTRACT
A study was conducted at the Research Farm of the Department of Agronomy, Delta state University, Asaba Campus, Nigeria to evaluate the effects of spent motor oil on soil and growth of *Arachis hypogaea.* 0.0, 2.0, 4.0, 6.0, 8.0 and 10.0% (wlw) of the oil constituted treatments. The results showed that spent oil in soil has highly significant ($P \leq 0.05$) effects of some soil physico-chemical properties including nitrogen, pH, carbon and heavy metals properties. The oil also significantly reduced ($P \geq 0.05$) percentage germination and delayed germination as well as the growth indices of *Arachis hypogaea*. The effects being oil dose dependant. This study has demonstrated that spent motor oil has significant effects or reducing some soil physico-chemical parameters, percentage germination and growth performance of *Arachis hypogaea.* The study has important ecological implications especially in the Niger Delta area.

KEYWORDS: Spent oil, soil physico-chemical properties, seedling emergence, growth indices, *Arachis hypogaea*

INTRODUCTION

Groundnuts, also known as peanuts, are considered a very healthy snack. They belong to the family Fabaceae and are native to regions like South America, Mexico and Central America (FAO, 2002). It is successfully grown in other parts of the world as well. It is one of world's principal oilseed crops (Mukhter *et al.*, 2010). It ranks fourth in oil production after Soya beans, cotton seed and rapeseed. Major groundnut producers in the World are China (40.1%), India (16.4%), Nigeria (8.2%), USA (5.9%), Indonesia (4.1%) and Sudan (5.23%) (FAO, 2002). Groundnut kernels are consumed directly as raw, roasted or boiled kernels or oil extracted from the kernel is used as culinary oil. Nigeria is the largest groundnut producer in Africa (Sokoto *et al.*, 2010). The nuts are also used as animal feed and industrial raw materials (oil, cake and fertilizer). These multiple uses of this crop make it an excellent cash crop for both domestic and foreign trade in several developing and developed countries (Olawale and Ayo, 2000; Mukhter *et al.*, 2009). Groundnuts and groundnut products are very beneficial in the treatment of hemophilia and other such inherited blood disorders. People suffering from nose bleeding also benefit from eating groundnuts and it is also helpful in reducing excessive menstruation bleeding in women (FAO, 2002). Groundnuts are rich in vitamins, contain at least 13 different types of vitamins that include vitamins A,B,C and E together with 26 essential minerals like calcium, zinc, iron, boron, potassium, phosphorus, manganese, magnesium, copper, fat, sodium, water, proteins, carbohydrate and fibre (Iwo and Obok, 2008). Many of these materials help in brain function and development and also assist in the maintenance of strong bone. They are also rich in anti-oxidants which help in reducing the risk of Contacting cardiovascular diseases, cancer risk and anti-ageing, thus keeping the body young and fit. Groundnuts are also very rich in five main nutrients required by the body to maintain and repair the tissues namely, food energy, protein, prosperous, thiamin and niacin hence they are highly recommended to growing children, expecting mothers and nursing mothers. (Obasi, 2008). Spent motor oil also called used lubricating oil is obtained after servicing and subsequently during oil from motor automobiles. The disposal of spent oil into gutters, water drains, open vacant plots and farms in Nigeria is a common occurrence and this is mostly done by automatics and allied artisans with workshops on roadsides and open places. Agbogidi (2011a) reported that spent oil is the commonest soil contaminant in the rural areas of Nigeria where agriculture/farming forms the mainstay of the rural inhabitants. The used oil may contain some toxic materials including heavy metals that could affect growth, yield and general performance of plants (Agbogidi and Egbuchua, 2010). Although studies have been conducted on spent oil contamination Anoliefo and Vwioko (1995), Anoliefo and Edegbai (2001), Vwioko and Fashemi (2005), Agbogidi (2009a), Agbogidi (2010a), Agbogidi (2010b) and Agbogidi (2011b) on the growth of plants, oil in soil has been shown to have significant impact on plant growth, yield and performance (Inoni *et al.,* 2006; Ngoku *et al.,* 2008 and Agbogidi, 2009b). There is however, paucity of documented information on the effect of oil on the growth of groundnut. It is against this background that a study as this has been embanked on. The present study has been designed to assess the effects of spent oil contamination on soil physico-chemical properties and growth performance of groundnut.

MATERIALS AND METHODS

The study was carried out in 2011 at latitude 6^{o} 14^{1} N and longitude $6^{o}49^{1}$E at the Research and Teaching Farm of the Department of Agronomy, Delta State University, Asaba Office, 2010). Ex-dakar (SAMNUT) was purchased as a single batch from the International Institute for Tropical Agriculture (IITA), Ibadan, Oyo State, Nigeria while the spent motor oil was obtained as a pool used oil from 10 different motor mechanic workshops in Asaba, Delta State. The seeds were subjected to viability test using flotation technique. The soil samples were obtained from the Agronomy Farm as pooled sample; the soil was air-dried and passed through a 2mm sieve. The oil was applied at 0, 2.0, 4.0, 6.0, 8.0 and 10.0% w/w. The soil/oil samples were thoroughly mixed together with hand and later poured into bottom-perforated polypots (35x30cm in dimension). The seeds were then planted and the polypots watered to field capacity immediately after planting and subsequently, once in two days. The experiment was laid out in a randomized complete block design and replicated 4 times. The polypots were kept in the nursery for subsequent examination. Parameters measured were % germination, plant height, number of leaves and leaf area. The soil physico-chemical properties as influenced by spent oil addition to soil were also monitored. The concentration of trace elements was also determined. The analysis was carried out at the Nigeria Institute of Oil Palm Research, Nifor, Benin, Edo State Nigeria. Metals present included iron, zinc, copper, lead, cadmium, manganese, nickel and chromium. Data collected were exposed to analysis of variance while significant means were separated with the Duncan's multiple' range tests using SAS (2005).

RESULTS AND DISCUSSION

Table 1 shows the soil physico- chemical properties of the studied site prior to experimentation. The soil physico-chemical properties as affected by the presence of spent oil are presented in Table 2. Treatment had no significant effect ($P \geq 0.05$) on soil physical properties.

TABLE 1. Physico-chemical properties of soil before experimentation

Parameters	Values
Sand (%)	94.5
Silt (%)	2.1
Clay (%)	3.4
Soil P^{H}	5.60
Textural class	Sandy loam
Organic carbon (%)	0.91
Organic matter (gkg^{-1})	2.64
Total N (%)	0.06
Available P (mg/kg)	30.00
Ca^{2+} (cmol/kg)	1.31
Mg^{2+} (cmol/kg)	0.16
Na^{+} (cmol/kg)	0.25
K^{+} (cmol/kg)	0.17
H^{+} (cmol/kg)	0.45
$Al3^{+}$ (cmol/kg)	0.08
ECEC (cmol/kg)	2.42
Base saturation (%)	78.10

TABLE 2. Physico-chemical properties of soil as affected by spent motor oil in soil

Parameters	Values
Sand (%)	96.0
Silt (%)	0.9
Clay (%)	3.1
Soil pH	5.8
Textural Class	Sandy Loam
Electrical Conductivity (µg/cm)	102.4
Organic Carbon (%)	1.28
Organic matter (g/kg^{-1})	2.84
Total N (%)	0.02
C/N	64.0
Available P (mg/kg)	36.41
Ca^{2x} (cmol/kg)	1.66
Mg2t (cmol/kg)	0.64
Nat (cmol/kg)	0.16
K^{t} (cmol/kg)	0.21
H^{t} (cmol/kg)	0.83
Al^{3+} (cmol/kg)	0.05
TEB	2.67
TEA	0.88
ECEC (cmol/kg)	3.55
Base saturation (%)	75.21
Trace elements (%)	1.6

TABLE 3. Germination response of *Arachis hypogaea* as affected by spent motor oil in soil

Oil in Soil	% germination	Days to germination
0	100.00a	4.0e
2.0	89.46b	4.8d
4.0	67.42c	5.7c
6.0	45.75d	6.5b
8.0	20.81e	7.2a
10.0	0.00f	0.0f

Means in the same column with different letters are significantly different ($p \leq 0.05$) using Duncan's multiple range Tests.

TABLE 4. Effects of spent motor oil on some agronomic parameters of *Arachis hypogaea* at 6 weeks after planting

Oil in soil % w/w	Plant height (cm)	No of leaves	Leaf area(cm^2)	Canopy spread (%)
0.0	30.64a	46.70a	70.42a	60.72a
2.0	25.066	32.52b	42.61b	49.40b
4.0	18.45c	22.10c	28.66c	30.02c
6.0	7.69d	14.72d	17.04d	16.28d
8.0	4.72e	8.41e	9.01e	5.01e
10.0	0.00f	0.00f	0.00f	0.00f

Means in the same column with different letters are significantly different ($p \leq 0.05$) using Duncan's Multiple Range Tests.

However, visual observation showed that plots that received spent oil treatment reduced water infiltration and percolation in the soil. This resulted in water accumulating in small pools. Air- drying of the impacted soils took relatively longer time. On drying, the soil gave a cemented waxy appearance which more or less repelled or resisted water /rewetting. This result indicated that spent oil in soil has a significant effect on oil properties like nitrogen content, pH, carbon and presence of trace heavy metals. Metals present included iron, zinc, copper, lead, cadmium, manganese, nickel and chromium. This observation is in harmony with earlier reports of Atuanya (1987) and Agbogidi and Egbuchua (2010) who noted that oil in soil has deleterious effects on the biological, chemical and physical properties of the soil depending on the dose, type of the oil and other factors.

All the seeds of the groundnut sown in the uncontaminated soils germinated on the 4th day after sowing. Significant reductions ($P \geq 0.05$) were however, observed in the germination percentage of *Arachis hypogaea* seeds sown in soils contaminated with the spent oil. The reduction was also observed to be oil-dose dependent. Oil in soil also delayed seedling emergence as seeds sown in oil contaminated took longer days to sprout (Table 3).This finding supports the reports of Anoliefo and Vwioko (2001) on *Chromolaena odorata*, Sharifi *et al.* (2007) on six plant species and Agbogidi (2009a) on cowpea. The performance of the groundnut sown in the oil treated soil also shown significant reduction when compared to seedlings as grown in the control plots are presented in Table 4. Reduced plant heights, canopy spread and total dry matter of plants exposed to oil treatments have also be reported by Anoliefo and Vwioko (2001), Agbogidi and Nweke (2005), Agbogidi *et al.* (2005) and Tigere *et al*. (2006). The reduction could be due to one or a combination of the following factors: unfavourable soil conditions mainly due to insufficient aeration following a decrease in the air filled pore space (Atuanya, 1987), effect on soil microbes (Ekundayo and Benka-Coker, 1995), presence of toxic oil components/herbicidal properties of the oil (Siddiqui and Adams, 2002), reduced biochemical activities and metabolic activities as well presence of heavy metals (Agbogidi and Egbuchua, 2010) and a disruption in the soil water-plant binterrelationship(Agbogidi, 2011a).

CONCLUSION

This study assessed the effect s of spent another oil on soil physio-chemical properties and growth of *Arachis hypogaea* in Asaba, Delta State, Nigeria. The study showed that spent oil in soil significantly affected soil physico-chemical properties, reduced percentage germination and delayed germination as well as the growth indices of *Arachis hypogaea.* The effects were however oil dose dependent.

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