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The Effect of Mixed Organic Amendments on the Shoot Length of Zea Mays Grown in Condemned Engine Oil Polluted Soil

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Abstract. The ameliorative effect of varied weights (1kg, 2kg, 3kg 4kg) of mixed organic amendments: goat droppings, chicken litter and sawdust on the shoot length of Zea mays grown on different intensities of condemned engine oil pollution (250ml, 500ml, 750ml, 1000ml) was carried out in a field experiment using 6kg of soil per pollution level, each pollution level was triplicated. There were a total of 60 experimental pots. The shoot length measurement was taken at weekly interval for six weeks. Statistical analysis showed that the mixing of the organic amendments has positive influence on the growth of Zea mays in both the high and low pollution levels especially in the 4kg mixed organic amended soil. There is a significant difference in the weekly mean growth for all the amendments and there is also significant difference in the weekly mean growth for all the levels of pollution.

Keywords: Condemned engine oil, Mixed organic amendments, Goat droppings, Chicken litter, Sawdust

1. Introduction

The effect of crude oil and its fractions on plants can be related to its short and long term toxicities, persistence and dispersion properties. It may affect plants by retarding seed germination and reducing plant height, stem density, photosynthetic rate and biomass or resulting in complete mortality (Lin and Mendelssohn, 1996; Mendelssohn *et al*., 1990). Chlorosis of leaves, plant dehydration, stunted growth and death of the growing parts were the effects of exposing maize seedlings to increasing concentration of crude oil. Oil also affects plants indirectly by creating certain conditions which make nutrients such as nitrogen unavailable to them, low nutrient availability results from the fact that petroleum hydrocarbons have high carbon content but are poor suppliers of nitrogen and phosphorus.

Various methods of protecting plants against problems created by oil contamination include use of sorbent materials, chemical dispersants and burning. Most of these methods have undesirable ecological effects both on the crops and the environment. Therefore, protecting the plants with vegetative components that form part of the environment becomes necessary (Gelta *et al*., 2004; Lin and Mendelssohn 2004). Application of organic manures also improves the soil microbial properties (Eck and Stewart, 1995). The benefits derivable from the use of organic materials have however not been fully utilized in the humid tropics due to the huge quantities required to satisfy the nutritional needs of crops as well as transportation and handling costs which constitute major constraints. They are rarely available to the small-scale farmers in the required large quantities (Ibia *et al.,* 2002). Complementary use of organic manure has been proved to be a sound soil fertility management strategy in many countries of the world (Ibe , 2000).

The use of sawdust as part of bioremediative measures in condemned engine oil contaminated soil has been previously studied by (Okore and Mbanefo, 2011), in crude oil polluted soil by (Akonye and

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Onwudiwe, 2004). Poultry litter also has significant positive effect on the bioremediation of gasoline – spilled soil (Rahman *et al*., 2002) and on condemned engine oil polluted soil (Okore and Mbanefo, 2011). Goat droppings as an organic manure equally has bioremediative potentials as reported by Okore and Mbanefo, (2011). Amending oil contaminated soils with poultry manure, should possibly improve soil fertility and maize production (Amadi and Ue Bari, 1992). The use of goat droppings, chicken litter, sawdust separately in amending condemned engine oil polluted soil for the growth of *Zea mays* was carried out by Okore and Mbanefo, 2011. The results obtained proved that the three organic amendment recorded high shoot length of *Zea* mays. It was based on this that the current research was carried out to observe the growth response of the three organic amendments (goat droppings, chicken litter, sawdust) mixed together in varying weights to amend condemned engine oil polluted soils at different levels of pollution.

Table 1: The mean weekly lengths of Zea mays grown on soil amended with different weights of mixed organic amendments and treated with varying concentrations of condemned engine oil.

Level of pollution	**Mixed organic amendments(kg)**	**MEAN WEEKLY SHOOT LENGTHS OF ZEA MAYS (cm)**					
		WK1	WK2	WK3	WK4	WK5	WK6
250ml of engine oil/6kg soil	0kg	2.4	5.2	8.0	10.8	13.6	16.4
	1kg	3.7	6.4	9.1	11.9	14.6	17.3
	2kg	4.5	9.1	13.7	18.4	23.0	27.6
	3kg	4.8	7.4	9.9	12.4	19.4	27.5
	4kg	7.3	17.5	45.2	45.2	45.2	45.2
500ml of engine oil/6kg soil	0kg	_	_	_	_	_	_
	1kg	3.7	6.2	8.7	11.2	13.7	16.1
	2kg	4.4	5.0	6.8	8.7	10.6	12.4
	3kg	3.6	6.9	10.2	13.5	16.8	20.1
	4kg	6.0	8.3	11.3	18.0	25.0	32.0
750ml of engine oil/6kg soil	0kg	0.3	1.4	1.7	2.1	2.4	2.7
	1kg	2.2	4.3	6.4	8.5	10.6	12.7
	2kg	5.6	8.8	12.0	15.3	18.5	21.6
	3kg	4.1	6.4	8.7	11.1	13.4	15.7
	4kg	6.5	11.5	16.5	21.5	26.5	31.5
1000ml of engine oil/6kg soil	0kg	_	_	_	_	_	_
	1kg	_	_	_	_	_	_
	2kg	2.1	3.5	5.6	7.7	9.8	11.9
	3kg	_	_	_	_	_	_
	4kg	4.4	7.8	11.2	14.6	18.0	21.4

2. Materials and Methods

Soil samples were obtained at a depth of 0-30cm, from the school farm land in Federal Polytechnic, Nekede, Owerri, Imo State, Nigeria. The soil had no previous exposure to petroleum hydrocarbon. The seeds of *Zea mays* were obtained from College of Agriculture Umuagwo, Imo State. The condemned engine oil used was obtained from a mechanic workshop in Owerri, Imo State. The mixed organic amendments (sawdust, chicken litter, and goat droppings) were equally collected from animal farms in

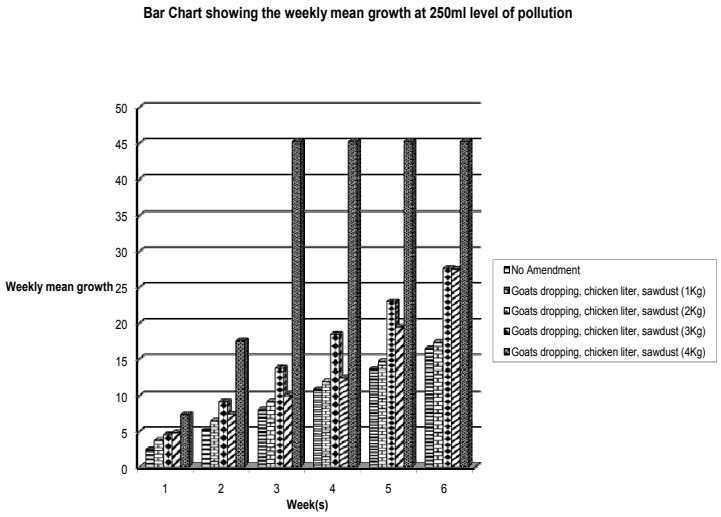
Mbano, Imo State. Polythene bags measuring 45cm x 45cm (served as pots) were used for the experiment. They were perforated with five small holes to allow easy drainage.

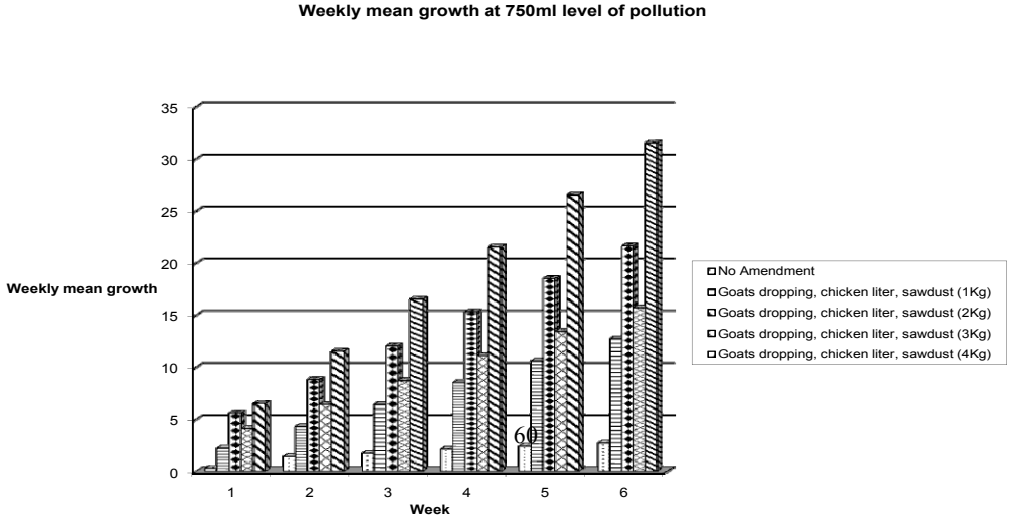
3. Soil Treatment

The experimental unit had 6kg of soil weighed into each polythene pots after thorough mixing with the condemned engine oil. The mixed organic amendments were weighed approximately 0kg, 1kg, 2kg, 3kg, 4kg each and added to all polluted soils i.e 250ml of engine oil/6kg of soil, 500ml of engine oil/6kg of soil,750ml of engine oil/6kg of soil, 1000ml of engine oil/6kg of soil, and each experimental unit was triplicated. The whole experimental setups were left for 12 days in the field after which 3 seeds of *Zea mays* were planted in each polythene pot, and watered daily at 6.00 GMT. The shoot lengths were determined weekly for 6 weeks). The data obtained from the experiment were analyzed statistically.

4. Result

The growth rate increased from 0kg to 4kg mixed organic amendment at the different levels of condemned engine oil pollution during the 6 weeks of measurement but higher shoot lengths were recorded in the lower pollution levels: in 250ml it increased from 16.4cm(0kg mixed amendment) to 45.2cm(4kg mixed amendment); in 500ml from 0cm(0kg mixed amendment) to 32.0cm(4kg mixed amendment); in 750ml from 2.70cm(0kg mixed amendment) to 31.5cm(4kg mixed amendment) while in 1000ml from 0cm(0kg mixed amendment) to 21.4cm(4kg mixed amendment)



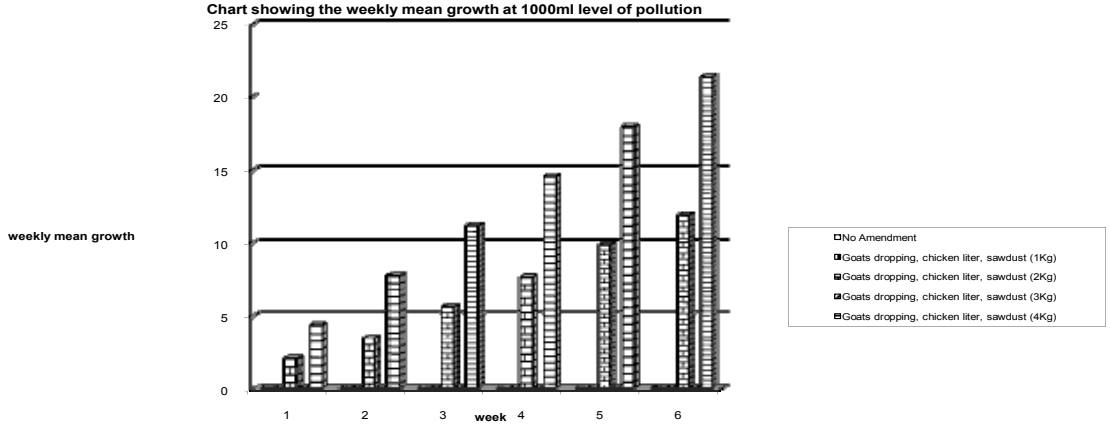


5. Discussion

The addition of the mixed organic amendments significantly improved the growth of *Zea mays* at all intensities of condemned engine oil pollution, especially higher weights of the mixed amendments. This shows that mixed organic amendments: sawdust, poultry litter and goats droppings are beneficial in protecting and limiting the toxicity of oil contamination to plants. In other words, the level of oil contamination determines the quantity of mixed organic amendment to be used. The protective and bioremediations potential of sawdust, poultry litter have previously being studied (Chen and Lee, 1997; Akonye and Onwudiwe, 2004; Rahman *et al*., 2002; Amadi and Ue Bari, 1992) and has been confirmed by the result of this research work. The net assimilation rate showed significant improvement with presence of sawdust at all intensities of engine oil pollution from this research work and is confirmed by the work of Offor and Akonye, 2006; Okore and Mbanefo, 2011. This maybe related to the ability of sawdust to absorb oil films thereby reducing the toxic effects of the engine oil (Akonye, 2004).

The response of *Zea mays* depended on the concentrations of the applied engine oil. Within one week of exposure to oil pollutant *Zea mays* experienced stress in growth. That is chlorosis, reduction in growth and wilting were experienced at all levels of engine oil pollution in the unamended engine oil polluted soil.

In conclusion, oil polluted soils become unsuitable for growth of plants for a long time until it is amended with suitable organic amendments. This study documents the use of organic amendments to improve the growth of *Zea mays* in different levels of condemned engine oil polluted soils. The use of the separate amendments (goat droppings, chicken litter, sawdust) encourages higher shoot length of *Zea mays* (Okore and Mbanefo, 2011) than mixing the organic amendments as observed in this research work. Also increasing the weights of the organic amendments in all levels of oil pollutions should be adopted for improved bioremediation and growth of *Zea mays* as shown from the result of this research work.



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