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Effect of Oil Palm Effluents and Fibre on Selected Soil Properties, Carbon, Nitrogen, Potassium and Phosphorous.

Akinyele, S. Ajibade and Fatoye, O. Abiodun
Department of Science Tech, Federal Polytechnic Ado Ekiti, Nigeria.

Abstract: *The effect of oil palm waste as a plant organic manure on soil Carbon, Nitrogen, Potassium, Phosphorous were carried out. Replicate applications of the wastes into the soil at equivalent rates of 10, 20 α 30t/ha were applied to cultivated soil. The soil organic Carbon, Nitrogen, Phosphorous, Potassium were determined after three weeks of application and results shows that the waste and rate of application increased the level of mineral in the soil. The effectiveness of these wastes in soil remediation is a function of the Potassium, Phosphorous, present in the wastes. The application of the waste to soil will serve as a cheaper source of soil mineralization compared to the expensive and scarce inorganic fertilizers.*
Keywords: *Effluent, fibre, soil properties.*

I. Introduction

Most agricultural soils in the southern and middle belt of Nigeria are very good for various cultivable crops ranging from carbohydrate food such as Yam, Cassava to vegetables. The Northern part of the country has low vegetation making the surface soil highly exposed to surface erosion from wind and rainfall While excessive soil erosion and unguided agricultural practices make the tropical soil prone to rapid depletion of soil nutrients. This process has drastically reduced the agricultural produce such as grains and nuts that are very common in the zone. To improve the quality and quantity of food crops, there is need to source for an alternative and cheaper means of replenishing the soil productive capacity. Several authors have reported the use of organic fertilizers, animal manure and plant wastes as alternative source for mineral fertilizers Ano & Agwu (2005),Mbagwu(1981),Agbola (1978), Odiete *et al* (1999) & Wood et al (1979). The oil palm fibre and effluents forms the major solid and liquid wastes from oil palm processing industries. Ma (2000), Hwang *et al* (1978), Habibab (1998), have reported that oil palm effluent is rich in organic matter, Potassium, Nitrogen, Phophorous and calcium. While indigenous oil palm waste in Nigeria have also been found to contain high level of Phosphorous and Potassium, Akinyele *et al* (2009,2011) oil palm effluent have also been reported to improve the fertility of the soil.

The objective of this work was to look at the effect of oil palm waste; fibre and effluent on the nutrient level of Nitrogen, Carbon, Potassium and Phosphorous in the soil.

II. Materials And Methods

The plot used for this study was selected from part of the unproductive farm land of the federal polytechnic Ado –Ekiti Nigeria. The land was manually cleared, harrowed, ploughed and divided into blocks with each separated by 1m ground row. Each block measuring 3m by 3m and separated by 0.5m alley way. The soil was amended with soil filtered effluent and fibre. Three different rate 0, 10, 20 and 30 kg/ha were carried out. The treatment was arranged in a randomized complete block design and was replicated three times. Top soil of 0-200m were collected before and after amended and analysed for Nitrogen, Carbon, Potassium and Phosphorous. Total organic carbon was determined using the walker- black wet oxidation method, Phosphorous by vanado- molybdate, Nitrogen by khjeldahl method while Potassium was determined by using the flame ionization spectroscopic method AOAC,(2005).

III. Results And Discussion

The result of mineral composition of the fibre and effluent as presented in table 1 shows that the values of the minerals recorded in the fibre were higher than values recorded in the effluent except for Phosphorous. This observation may be due to the fibrous nature of the plant and cellulosic nature of the fibre.The higher Phosphorous recorded in the effluent may be attributed to the effect of the process water used. The value recorded for phosphorous were higher than result obtained by Habib,(1995) from malalysia oil palm effluents.

Table 1; Chemical composition of the oil palm effluent and Fibre.

Parameter	Nitrogen(%)	Carbon(%)	Phosphorus (mg/kg)	Potassium (cmol/kg)
Effluent	1.24±0.01	2.37± 0.01	44.60± 0.24	557.81±1.20
Fibre	1.67±0.02	2.48±0.01	33.10± 0.20	841.75± 0.70

The effect of the various treatments on chemical composition of the soil as presented in Table 2 and 4 shows that effluent and rate of application significantly improve the level of all the minerals.

Table 2; Chemical composition of the soil before and after treatment with oil palm effluent.

Parameter	Control	10kgh-	200kgh-	30kgh-
Organic Carbon(%)	1.03 ± 0.10	1.46 ± 0.10	4.62 ± 0.20	4.81 ± 0.15
Nitrogen(%)	0.06 ± 0.01	0.14 ± 0.01	0.23 ± 0.10	0.36 ± 0.01
Potassium (cmol/kg)	0.20 ± 0.01	0.24 ± 0.01	0.40 ± 0.03	0.58 ± 0.02
Phosphorous (mg/kg)	33.53 ± 1.40	35.56 ± 1.44	38.66 ± 0.30	40.23 ± 0.20

Table 3; chemical composition of the soil before and after amendment with oil palm fibre

Parameter	Control	10kgh-	20kgh-	30kgh-
Organic Carbon (%)	1.03 ± 0.10	1.80 ±0.20	2.30 ±0.10	3.22±0.20
Nitrogen (%)	0.060 ±0.01	0.16 ±0.01	0.26 ±0.10	0.38±0.01
Potassium (cmol/kg)	0.20 ±0.01	0.31 ±0.10	0.42 ±0.04	0.57± 0.02
Phosphorous (mg/kg)	33.53 ±1.40	40.05 ±1.50	42.10 ±1.20	48.32±1.06

The highest effect was obtained with 30kgh- application rate. The organic carbon and nitrogen increase with increased application rate, and the value obtained are above the initial values reported for most crops that strive in the tropical region of Nigeria. Therefore fibre and effluent will improve the level of the minerals in soil and also increase the water retention capacity and infiltration rate of the soil.

The result observed for organic matter and Nitrogen is in support of report by Onyekwelu *et al* (2006) and in agreement with report of Arab *et al* (1997). Comparably, there was higher increase in the mineral compared to the use of sewage and animal dung in among soil nutrient (Mbah and Mbagwu, 2006). There was increase in the level in the level of phosphorous in the amended soil when compared to the control soil. Which indicate that as the waste decompose the phosphorous in them is released into the soil. Sufficiency level for phosphorous have been reported for tropical region of southern Nigeria to be 25mg/kg of soil and result from this study have shown than the application rate can raise phosphorous value above the sufficiency level. But, high phosphorous in soil is deleterious as excess can tie up other elements such as Iron and Zinc and inhibit their uptake by plants. Therefore the use of the fibre and effluents as a source of phosphorous in soil should be guided by the need and soil test

Increasing the rate of application of the oil palsm waste consistently increased the potassium in the soil. This can be correlated to the high level of potassium in effluent and fibre as earlier reported by Akinyele *et al* (2009 and 2011) and the result is in agreement with the work of Pitman and Singh (1993).

In Potassium requirement in the tropical zone of Nigeria as reported by is 0.40c mol/kg, hence application of the waste to soil will ensure adequate level of potassium.

IV. Conclusion

The effect of oil palm wastes and rate of application was carried out or selected mineral of soil. The level of nitrogen, organic carbon, phosphorous and potassium in treated soil were both influenced by the nature or type of waste and application rate. The higher increase from the fibre over the effluent may be attributed to the fibrous nature of the fibre. The lower value in the level of nitrogen in fibre may be due to slow decay process while that high solubility of potassium in water may account for its higher value in effluent due to large volume of water it contains.

The use of the selected oil palm waste could be of economic value to farmers in place of the expensive mineral fertilizers. The fibre in particular will also be used to reduce the loss of water from the soil since it could be used for mulching.

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