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Elemental and Proximate Contents of *Amaranthus Hybridus L.* in Soil Supplemented with Cassava Peel of Varied Time Treatment

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Abstract- Studies were conducted to examine the elemental and proximate contents of Amaranthus hybridus L. in soil supplemented with cassava peel of varied time treatment. Compost were prepared by mixing sectioned cassava peels with 2kg of sandy-loam soil and maintained for 1, 2, 3, 4, 5 and 6 weeks alongside a control (0) containing 2kg of sandy loam soil without cassava peel. The contents of Ca, P, K, Na, and Mg significantly ($P < 0.05$) increased with increase in composting time of cassava peel. Similarly, higher contents of Ca, P, K, Na and Mg were recorded in leaf of A. hybridus in treatment with higher composting time of cassava peel compared to treatments with lower composting time and the control. The leaf proximate contents in A. hybridus significantly ($P < 0.05$) increased with increase in the composting time of cassava peel. This result suggests that a longer duration of composting time is necessary for optimum biodegradation, increased nutrients contents and reduced inhibitory substances in cassava peel manure.

Index Terms- Elemental, proximate, soil, *Amaranthus hybridus*, cassava peel.

I. Introduction

Organic manure is indispensable to the nutrients enhancement of the soil because of its immense value in supplying nutrients slowly in the soil [6]. Organic manure increases the fertility and productivity of soils by providing all the nutrients that are required by plants but in limited quantities, maintains soil carbon to nitrogen ratio, improves the soil physical, chemical and biological properties, and increases the water holding capacity of the soil [12;21]. Composting is strategically designed to convert organic substrate aerobically by microorganisms into carbondioxide, water, minerals, and stabilized organic matter. It is characterized by a solid stage fermentation process of microbial degradation and mineralization [5;18]. It requires a regulated environmental condition such as moisture, aeration and temperature for optimum microbial degradation [9;23]. Cassava peels consist of cellulose, hemicelluloses and lignin, hence it is a nutrient supplements. *Manihot esculenta* Crantz, from which the cassava peels were generated, is a global stable economic and food crop [25]. *Amaranthus hybidus* L. belongs to the family Amaranthaceae, and is known to be domesticated prehistorically in the highlands of tropical and subtropical America [4;20]. It is an erect, glabrous or hairy plant with alternate simple leaves and flowers that are borne in axillary clusters or in terminal ears or panicles [11;20]. The nutritional value and yield of its grains compares favourably with maize and other true cereals, while the leaf and young plants are consumed as vegetables in soups and often gathered as potherbs [2;3;11]. The excessive reliance on chemical fertilizers and the negligence shown to the conservation and utilization of organic nutrient sources have caused the exhaustion of soil of its nutrient reserves and led to soil health problems not conducive to achieving consistent increase in agricultural production [17;21]. Therefore, this research was conducted to assess the nutrient profiles of the test crop in soil treated with cassava peels of varied composting time.

II. MATERIALS AND METHODS

Germination Study:

Cassava peels were obtained from *Manihot esculenta* Crantz from Abak Local Government Area of Akwa Ibom State. Cassava peels were dried and further sectioned into tiny particles of about 0.50cm. Compost was prepared by mixing the sectioned cassava peels with 2kg of sandy-loam soil obtained from Abak Local Government Area of Akwa Ibom State, Nigeria, and stacked into a heap of 1.50m height and 1.50m base width and left to compost for 1, 2,3, 4, 5 and 6 weeks, with regular turnings every 2 days. The moisture content was maintained at 68- 70%. Each treatment was transferred into a perforated polybag. A control (0) was set up containing 2kg of sandy loam soil without cassava peel.. Five (5) seeds of *A. hybridus* were sown in each polybag and after germination were thinned down to 3 seedlings per bag. Each treatment was replicated 5 times using completely randomized design. The experimental set up was maintained at a mean minimum temperature of 22.44^{o}C and a mean maximum temperature of 33.07^{o}C, under natural light condition for eight (8) weeks.

Analysis of Soil Samples:

Top soils of 0-15 cm depth were collected from the study site, Abak Local government Area of Akwa Ibom state, Nigeria. Soil chemical properties were analysed using standard procedures of [13].

Analysis of Plant Samples:

Leaf samples of *Amaranthus hybridus* were harvested at the end of the experiment (8 weeks), and thoroughly washed with water. Leaf samples were rinsed with distilled water, kept in polybags and oven dried to a constant weight at 60^{o}C. The dried leaf samples were macerated to powder form using pestle and mortar and kept in sample bottles for analysis. Mineral and proximate content in leaf samples were determined using standard methods [7;13].

Statistical Analysis

Standard errors of the mean values were calculated for the separate readings and data were subjected to analysis of variance (ANOVA) according to the method of [16].

III. RESULT AND DISCUSSION

Table 1 shows the chemical properties of experimental soil before application of cassava peel. The experimental soil was slightly acidic with a pH of 5.40. Abak, the study area is a tropical environment with its characteristic low nutrients contents and strong acidity, which is attributed to high rainfall and consequently leaching of basic cations out of the root zone of soils [17;19].

Table 2 shows the chemical properties of experimental soil with cassava peels conditioned for varying duration of time. The contents of calcium, phosphorus, potassium, sodium and magnesium in the experimental soils significantly ($P < 0.05$) increased with increase in composting time of cassava peel. These values were relatively higher than that of the control (0) treatment. Nutrients are released during aerobic decomposition of organic manure [1;24]. The released nutrients together with temperature effects have been identified as contributory factors in the biodegradation of cassava peels by microorganisms [14;22]. Dead plant tissues tend to undergo decay and are transformed into microbial cells and a vast heterogenous body of carbonaceous compounds [21]. Therefore, microbial metabolism are enhanced due to the available carbonaceous compounds which leads to increased soil organic matter [8].

The leaf mineral nutrients contents of *A. hybridus* in soil supplemented with cassava peels conditioned for varying duration of time are presented (Table 3). The high mineral nutrient contents in treatment with higher composting time of cassava peel may be attributed to the conversion of the secondary products in carbon sources for optimum metabolic processes in the test crop. Organic manure playss an important role in supplying the readily plant minerals and in providing better soil conditions [6;23]. Reduction in leaf mineral nutrient content at lower duration of composting time may be due to exhaustion of nutrients in the growth medium and accumulation of growth inhibiting metabolites. Processing and decomposition of cassava peel have been shown to reduce the cyanogenic glucoside to relatively insignificant levels [9;15].

Table 4 shows the leaf proximate contents of *A. hybridus* in soil supplemented with cassava peel conditioned for varying duration of time. Higher values of moisture, ash, fat, crude protein, crude fibre and carbohydrate were recorded at higher duration of composting time. Complex molecules such as carbohydrate and proteins play some crucial roles in the body of plants. Enzymes activities and protein synthesis as well as various metabolic processes have been shown to be regulated by nitrogen and carbon [10;22]. The digestion of cellulose and hemicellulose together with the nutrient composition from the organic manure enhance the formation of secondary products [9;24].

Table 1: Chemical properties of experimental soil before application of cassava peel

Parameters	Content
pH	5.40 ± 0.21
Organic matter (%)	2.20 ± 0.43
Total nitrogen (%)	1.24 ± 0.55
Available phosphorus (%)	0.97 ± 0.02
Calcium (mg/100g)	5.30 ± 0.13
Magnesium (mg/100g)	3.52 ± 0.16
Sodium (mg/100g)	2.02 ± 0.10
Potassium (mg/100g)	1.70 ± 0.25

Mean ± standard error from 5 replicates

Table 2: Chemical properties of experimental soil with cassava peels conditioned for varying duration of time

Duration (wks)	0	1	2	3	4	5	6
Mineral Element (g/kg)							
Ca	5.72 ± 0.27	6.63 ± 0.34	6.72 ± 0.12	7.07 ± 0.56	7.25 ± 0.26	7.43 ± 0.43	7.54 ± 0.31
p	0.99 ± 0.43	20.12 ± 0.25	25.17 ± 0.46	25.32 ± 0.24	25.56 ± 0.33	30.65 ± 0.41	30.72 ± 0.10
K	2.83 ± 0.17	5.26 ± 0.20	5.43 ± 0.35	6.64 ± 0.15	7.43 ± 0.07	7.84 ± 0.12	9.13 ± 0.27
Na	2.23 ± 0.33	3.20 ± 0.16	3.17 ± 0.20	4.14 ± 0.34	4.30 ± 0.25	5.20 ± 0.42	5.85 ± 0.36
Mg	3.40 ± 0.97	4.27 ± 0.63	4.32 ± 0.36	4.40 ± 0.33	4.52 ± 0.18	5.17 ± 0.23	5.32 ± 0.46

Mean ± standard error from 5 replicates

Table 3: Leaf mineral nutrient contents of *Amaranthus hybridus* in soil supplemented with cassava peels conditioned for varying duration of time

Duration (wks)	0	1	2	3	4	5	6
Mineral Element (mg/100g)							
Ca	32.12 ± 0.28	40.27 ± 0.53	42.14 ± 0.13	47.66 ± 0.77	50.42 ± 0.16	54.20 ± 0.26	60.32 ± 0.20
Na	4.08 ± 0.53	6.92 ± 0.35	8.20 ± 0.20	10.41 ± 0.64	10.83 ± 0.10	11.06 ± 0.45	12.20 ± 0.63
K	42.81 ± 0.24	56.21 ± 0.74	57.34 ± 0.43	59.17 ± 0.30	60.22 ± 0.36	62.08 ± 0.29	62.96 ± 0.27
Mg	180.20 ± 0.22	221.36 ± 0.36	221.70 ± 0.69	223.10 ± 0.26	227.41 ± 0.54	228.05 ± 0.43	230.10 ± 0.13
P	20.47 ± 0.66	28.21 ± 0.43	29.04 ± 0.29	31.46 ± 0.36	32.07 ± 0.47	33.02 ± 0.19	33.67 ± 0.39

Mean ± standard error from 5 replicates

Table 4: Leaf proximate contents of *Amaranthus hybridus* in soil supplemented with cassava peels conditioned for varying duration of time

Duration (wks)	0	1	2	3	4	5	6
Mineral Element (%)							
Moisture	15.78 ± 0.23	22.32 ± 0.32	25.20 ± 0.43	27.43 ± 0.31	30.09 ± 0.45	42.30 ± 0.21	46.07 ± 0.80
Ash	10.33 ± 0.42	12.24 ± 0.65	12.39 ± 0.32	12.67 ± 0.22	13.04 ± 0.46	13.93 ± 0.86	14.62 ± 0.21
Fat	9.02 ± 0.12	10.20 ± 0.33	10.47 ± 0.46	11.26 ± 0.54	12.30 ± 0.68	12.56 ± 0.35	12.90 ± 0.66
Crude protein	17.24 ± 0.18	20.07 ± 0.23	21.52 ± 0.56	22.46 ± 0.47	23.07 ± 0.63	24.10 ± 0.28	25.20 ± 0.16
Crude fibre	4.37 ± 0.10	6.02 ± 0.19	7.21 ± 0.43	7.80 ± 0.52	8.01 ± 0.09	8.21 ± 0.33	8.30 ± 0.26
Carbohy-drate	5.20 ± 0.31	7.32 ± 0.45	10.24 ± 0.32	12.56 ± 0.13	12.87 ± 0.44	15.06 ± 0.31	21.09 ± 0.43

Mean ± standard error from 5 replicates

IV. CONCLUSION

This study showed that regular recycling of organic wastes in the soil is the most efficient method of maintaining optimum levels of soil organic matter and agricultural productivity.

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