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Influence of Cassava Mill Effluent on the Growth Rate of Two Selected Arable Crop Species (*Zea mays* and *Vigna unguiculata* L)

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Abstract

Hydrogen cyanide is the dominant element in cassava mill effluent with several toxicological implications. Physiochemical analysis was carried out on the soil samples gotten from three different cassava tuber processing mills located at Amaoba, Umuarigha I, and Umuarigha II in Ikwuano Local Government area of Abia state. The parameters investigated were pH, nitrogen, phosphorous, organic carbon, organic matter; others were the sodium, calcium, potassium and magnesium contents. All the afore-mentioned parameters were also analyzed for control sample. The result showed that there was an increase in soil pH, nitrogen and magnesium content of the cassava mill soils. The effect on plant growth rate was studied using maize and cowpea as test crops. The number of leaves, stem girth and length was recorded for a period of eight (8) weeks. The result after eight (8) weeks showed that the growth rate of seedlings on the soil of the three different cassava mills was rapid more than that of the control. This research shows that the cyanide content of the cassava mill effluent had a stimulatory effect on the parameters measured and could serve as an efficient source of nutrient to the soil and thus to crops, making it an alternative to mineral fertilizers.

Keywords: Cassava effluent; Hydrogen cyanide; *Zea mays; Vigna unguiculata L*

Introduction

Cassava (*Manihot esculenta* Crantz, synonymous with *Manihot utilissima* Rhol) belongs to the family Euphorbiaceae. It is mainly a food crop whose tubers are harvested between 7-13 months based on the cultivars planted. The tubers are quite rich in carbohydrates (85-90%) with very small amount of protein (1.3%) in addition to cyanogenic glucoside (Linamarin and Lotaustiallin) [1,2]. This high carbohydrate content makes cassava a major food item especially for the low income earners in most tropical countries especially Africa and Asia [3]. The edible tubers are processed into various forms which include chips, pellets, cakes and flour. The flour could be fried to produce garri or steeped in water to ferment to produce fufu when cooked [4,5]. Cassava is one of the over 3000 types of plants that produce cyanogenic compounds [6,7] releases hydrogen cyanide (HCN) upon hydrolysis. This process of HCN production is known as cyanogenesis and makes cassava a potential toxic food to humans [8].

Fermentation is one of the oldest and most important traditional food processing and preservation techniques. Food fermentations involve the use of microorganisms and enzymes for the production of foods with distinct quality attributes that are quite different from the original agricultural raw material. The conversion of cassava (*Manihot esculenta*, Crantz syn. *Manihot utilissima* Pohl) to garri illustrates the importance of traditional fermentations.

Cassava tubers are rich in starch (20-30%) and, with the possible exception of sugar cane; cassava is considered as the highest producer of carbohydrates among crop plants. Without the benefits of modern science, a process for detoxifying cassava roots by converting potentially toxic roots into garri was developed, presumably empirically, in West Africa. The process involves fermenting cassava pulp from peeled, grated roots in cloth bags and after dewatering, the mash is sifted and fried. Microbial fermentations have traditionally played important roles in food processing for thousands of years. Most marketed cassava products like "gari", "fufu", "pupuru", "apu" etc., in Africa are obtained through fermentation. The importance of fermentation in cassava processing is based on its ability to reduce the cyanogenic glucosides to relatively insignificant levels. Unlike alcoholic fermentation, the biochemistry and microbiology is only superficially understood, but it is believed that some cyanidrophilic/cyanide tolerant microorganisms effects breakdown of the cyanogenic glucoside. Generally, fermented cassava products store better and often are low in residual cyanide content. The highly offensive odor emanating from the fermenting effluent calls for regulation in the discharge of the waste generated [9]. Cassava mill effluent can cause various environmental problems ranging from air pollution through the generation of offensive odor, soil degradation, also causing illness by promoting the breed of mosquito in most areas, cassava mills are mainly on small scale basis, owned and managed by individuals who have no basic knowledge of environmental protection. Though on small scale basis, there are many of them, which when put together, create enormous impact on the environment. This work therefore is aimed at assessing the effect of cassava mill effluents on the physicochemical properties of the soil and its effect on the growth rate of arable cereals (maize and cowpea).

Materials and Methods

Study area

The study was conducted by random collection of soil samples from three selected cassava mills (Amaoba, Umuarigha I and Umuarigha II) within Ikwuano L.G.A of Abia State.

Ikwuano is a local government area with its headquarters at Isiala Oboro. It has an area of 218 km^2 and population of 137,933. Ikwuano falls with latitude of 050 270 N and longitude of 070 340 E. It is characterized by bimodal rainfall, high temperature 290-320 with relative humility. The people are known for agricultural and marketing activities while the soil texture is sandy loamy.

Sample collection/Preliminary soil analysis

Preliminary soil analysis was carried out on both soil samples of the three different cassava mill sites and control sites to determine the physicochemical properties of the soil. Soil samples were randomly collected from the three different cassava mill sites at 15 cm depth from the top soil; same was done for the control at the Forestry Nursery. The soil samples were air dried and labeled accordingly. (Sample A, Sample B, Sample C and Control) before taken to the laboratory for analysis.

Seed sample collection and viability test

Seeds (maize and cowpea) were bought from Ndioro market in Ikwuano LGA and viability test was done by placing the seed into a container filled to water for some period of time (5 mins) so as to select the one that is fit for the study.

Nursery planting

Twelve poly-pots were filled with 5 kg of uncontaminated soil each for corn seeds; same was repeated for the cowpea seeds at the nursery department of Michael Okpara University of Agriculture, Umudike, to stabilize the species before transplanting.

Soil sample collection and preparation

Soil was randomly collected from three different sampling cassava mill sites at 15 cm depth from the top soil where evidently shown cassava effluent discharge. 18 poly-pots were filled with 5 kg of the soil from the three different cassava mill sites [six for each site]. Another set of 6 poly-pots was filled with 5 kg of garden soil (uncontaminated soil) which served as control for the experiment.

Seedling transplanting to the treatment poly-pots

After two weeks of planting at the nursery department, the seedlings of each species were transplanted into the experimental poly-pots according to their soil profiles. The experimental setup was watered at two Days interval, while poly-pots were perforated at the base to avoid water logging, the experimental was allowed for a period of eight weeks.

Method of data collection/analysis

The plants height and stem girth was measured in weekly intervals using a tape and number of leaves was counted and recorded. The experiment was laid out in a complete randomize block design (CRBD) with four replicates and three treatments. The result which was obtained was subjected to analysis of variance (ANOVA). Mean separation was done using fisher LSD at 0.05% probability two way mean value was subjected to studentized T-test which showed that plants planted on a cassava mill soils had a higher growth rate than those of the normal garden soil.

Results

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Control	11.40 ± 1.10^b	14.93 ± 0.90^a	18.30 ± 1.11^a	21.73 ± 0.25^a	24.30 ± 0.35^b	28.40 ± 1.13^b	31.80 ± 0.53^b	35.17 ± 0.15^b
Sample A	10.53 ± 0.76^c	14.43 ± 0.60^c	17.70 ± 1.04^c	21.10 ± 1.35^c	23.53 ± 0.84^c	27.63 ± 1.18^c	31.30 ± 0.30^c	35.00 ± 0.40^c
Sample B	10.27 ± 3.16^d	14.37 ± 2.61^d	18.13 ± 1.96^b	21.63 ± 1.99^b	25.07 ± 1.10^a	29.20 ± 1.65^a	32.73 ± 1.63^a	37.03 ± 2.42^a
Sample C	11.77 ± 2.04^a	14.60 ± 2.76^b	16.70 ± 3.40^d	18.40 ± 3.31^d	20.67 ± 2.96^d	23.40 ± 3.04^d	25.90 ± 4.27^d	27.93 ± 4.91^d

Table 1: Analysis for Cowpea Length. Keywords: a, b, c, d=Means with same superscript is not significantly different at P=0.005 level of significance. Control=Uncontaminated soil; Sample A=Cassava mill soil from Amaoba; Sample B=Cassava mill soil from Umuarigha I; Sample C=Cassava mill soil from Umuarigha II.

The result (Table 1) of the plant (Cowpea) of the plant length shows that there was no significant difference (P>0.05) from the length of control test crop during the period of the first week to the fourth week, this is attributed to the higher resistance of cowpea. From the fifth week to the eight week result shown that there was significant differences in the plant samples from the control which is accounted for the rapid growth in acidic solid.

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Control	2.03 ± 0.25^b	3.10 ± 0.00^a	3.57 ± 0.25^c	4.30 ± 0.01^a	4.57 ± 0.06^b	4.83 ± 0.25^b	5.30 ± 0.00^c	5.60 ± 0.00^c
Sample A	1.87 ± 0.12^d	3.00 ± 0.17^b	3.67 ± 0.12^b	4.13 ± 0.29^c	4.40 ± 0.17^c	4.77 ± 0.29^c	5.33 ± 0.58^b	5.60 ± 0.00^b

Sample B	2.00 ± 0.50^{c}	2.80 ± 0.50^{d}	3.67 ± 0.40^{a}	4.27 ± 0.29^{b}	4.73 ± 0.12^{a}	5.00 ± 0.36^{a}	5.40 ± 0.17^{a}	5.67 ± 0.12^{a}
Sample C	2.03 ± 0.40^{a}	2.97 ± 0.29^{c}	3.50 ± 0.53^{d}	3.73 ± 0.51^{d}	4.10 ± 0.50^{d}	4.43 ± 0.23^{d}	4.67 ± 0.21^{d}	4.97 ± 0.29^{d}

Table 2: Analysis for Cowpea stems Growth. Keywords: a, b, c, d=Means with same superscript is not significantly different at P=0.005 level of significance. Control=Uncontaminated soil; Sample A=Cassava mill soil from Amaoba; Sample B=Cassava mill soil from Umuarigha I; Sample C=Cassava mill soil from Umuarigha II.

The results (Table 2) show that stem girth (cowpea) had no significant difference from the first week to the fourth week, from the fifth week to the eight week result recorded that there was a significant difference in growth rate of the stem girth of the samples from the control.

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Control	6.00 ± 1.73^{bc}	9.00 ± 1.73^{b}	12.00 ± 1.00^{b}	15.33 ± 1.53^{b}	18.33 ± 1.15^{b}	21.33 ± 0.58^{c}	24.67 ± 0.58^{c}	28.67 ± 0.58^{c}
Sample A	6.00 ± 1.73^{bc}	7.33 ± 3.79^{c}	11.00 ± 4.00^{c}	14.33 ± 4.51^{c}	18.00 ± 4.00^{c}	21.67 ± 3.06^{b}	25.33 ± 3.51^{a}	28.67 ± 2.89^{b}
Sample B	7.00 ± 1.73^{a}	10.33 ± 1.15^{a}	13.00 ± 1.00^{a}	16.33 ± 1.53^{a}	19.00 ± 1.00^{a}	21.67 ± 1.53^{a}	25.00 ± 1.00^{b}	28.67 ± 1.15^{a}
Sample C	6.00 ± 1.73^{b}	7.00 ± 1.00^{d}	9.00 ± 0.00^{d}	8.67 ± 1.53^{d}	11.33 ± 0.58^{d}	15.33 ± 0.58^{d}	17.33 ± 1.15^{d}	19.67 ± 1.53^{d}

Table 3: Analysis for Cowpea and number of leaves. Keywords: a, b, c, d=Means with same superscript is not significantly different at P=0.005 level of significance. Control=Uncontaminated soil; Sample A=Cassava mill soil from Amaoba; Sample B=Cassava mill soil from Umuarigha I; Sample C=Cassava mill soil from Umuarigha II.

The result (Table 3) of the number of leaves (cowpea) show that there was no significant difference from the control during the period of the first week to third week, the growth rate of the number of leaves were same thing this weeks, from the fourth week to the eight week, the result shoed that there was a significant difference from the control, the three samples produced more leave than that of the control.

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Control	11.07 ± 0.90^{a}	14.43 ± 0.59^{a}	18.30 ± 1.61^{a}	23.13 ± 2.87^{a}	27.63 ± 3.35^{a}	31.67 ± 2.93^{a}	35.27 ± 2.73^{a}	37.27 ± 2.02^{a}
Sample A	8.87 ± 1.63^{d}	12.53 ± 1.48^{d}	15.37 ± 1.46^{c}	19.70 ± 0.96^{c}	23.10 ± 1.35^{c}	27.07 ± 1.92^{c}	31.13 ± 2.72^{c}	33.83 ± 3.29^{c}
Sample B	10.47 ± 0.92^{c}	14.13 ± 0.76^{b}	18.00 ± 1.00^{b}	21.43 ± 1.56^{b}	24.40 ± 1.66^{b}	28.30 ± 1.93^{b}	31.90 ± 2.79^{b}	36.27 ± 2.19^{b}
Sample C	10.57 ± 0.40^{b}	12.93 ± 0.40^{c}	15.17 ± 1.23^{d}	16.77 ± 1.57^{d}	19.57 ± 1.59^{d}	22.33 ± 0.65^{d}	24.63 ± 1.44^{d}	27.50 ± 1.57^{d}

Table 4: Analysis for Maize length. Keywords: a, b, c, d=Means with same superscript is not significantly different at P=0.005 level of significance; Control=Uncontaminated soil; Sample A=Cassava mill soil from Amaoba; Sample B=Cassava mill soil from Umuarigha I; Sample C=Cassava mill soil from Umuarigha II.

The result (Table 4) of the plant (maize) length shows that that there was a significant difference (P>0.05) between the growth rate of the samples from the control for the period of the first week to the eight week. Rapid growth rate recorded is attributed to increase of soil nutrients by the cyanide content.

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Control	2.60 ± 0.17^{a}	3.00 ± 0.17^{a}	3.57 ± 0.25^{a}	4.20 ± 0.10^{a}	4.83 ± 0.25^{a}	5.13 ± 0.15^{a}	5.83 ± 0.25^{a}	6.47 ± 0.12^{a}
Sample A	2.20 ± 0.53^{d}	2.70 ± 0.35^{c}	3.17 ± 0.12^{d}	3.93 ± 0.15^{c}	4.30 ± 0.00^{c}	4.77 ± 0.15^{c}	5.33 ± 0.46^{c}	5.90 ± 0.53^{c}
Sample B	2.37 ± 0.40^{b}	2.90 ± 0.17^{b}	3.47 ± 0.29^{b}	4.00 ± 0.17^{b}	4.50 ± 0.17^{b}	4.90 ± 0.17^{b}	5.53 ± 0.38^{b}	6.10 ± 0.44^{b}
Sample C	2.27 ± 0.25^{c}	2.53 ± 0.06^{d}	3.29 ± 0.10^{c}	3.90 ± 0.17^{d}	3.90 ± 0.17^{d}	4.33 ± 0.06^{d}	4.57 ± 0.06^{d}	4.70 ± 0.10^{d}

Table 5: Analysis for maize stem growth. Keywords: a, b, c, d=Means with same superscript is not significantly different at P=0.005 level of significance; Control=Uncontaminated soil; Sample A=Cassava mill soil from Amaoba; Sample B=Cassava mill soil from Umuarigha I; Sample C=Cassava mill soil from Umuarigha II.

Result (Table 5) show that stem girth (maize) had no significant difference on the first week and from the third week to the eight week there was a significant difference in the stem girth of the samples from the control.

Treatments	Week 1	Week 2	Week 3	Week 4	Week 5	Week 6	Week 7	Week 8
Control	4.00 ± 0.00^{a}	5.00 ± 0.00^{a}	6.00 ± 1.00^{b}	7.00 ± 0.00^{a}	7.67 ± 0.58^{c}	9.33 ± 0.58^{a}	9.33 ± 0.58^{a}	10.33 ± 1.15^{a}
Sample A	3.33 ± 0.58^{d}	4.00 ± 1.00^{c}	5.00 ± 0.00^{c}	6.33 ± 0.58^{c}	8.00 ± 1.00^{a}	9.00 ± 1.73^{b}	9.00 ± 1.73^{b}	9.67 ± 2.08^{c}
Sample B	3.33 ± 0.58^{c}	4.33 ± 0.58^{b}	6.00 ± 0.00^{a}	6.67 ± 0.58^{b}	7.67 ± 0.58^{b}	8.67 ± 1.53^{c}	8.67 ± 1.53^{c}	10.00 ± 1.00^{b}
Sample C	3.33 ± 0.58^{b}	3.67 ± 0.58^{d}	4.33 ± 0.58^{d}	5.33 ± 0.58^{d}	6.00 ± 1.73^{d}	7.00 ± 1.73^{d}	7.00 ± 1.73^{d}	8.00 ± 1.00^{d}

Table 6: Analysis for maize number of leaves. Keywords: a, b, c, d=Means with same superscript is not significantly different at P=0.005 level of significance; Control=Uncontaminated soil; Sample A=Cassava mill soil from Amaoba; Sample B=Cassava mill soil from Umuarigha I; Sample C=Cassava mill soil from Umuarigha II.

The result (Table 6) of the number of leaves (maize) shows that in the first week, there was no significant difference ($p<0.05$). There was a significant difference from the second week to the fourth week; the growth rate of the leaves was high. The fifth week to the eight week, the growth rate of the number of leaves show that there was no significant difference.

Treatments	Soil pH	P	N	OC	OM	Ca	Mg	K	Na	EA	EC	CN
Control	5.21 ± 0.13^{d}	19.73 ± 0.11^{d}	0.08 ± 0.00^{d}	1.14 ± 0.03^{d}	1.92 ± 0.01^{d}	7.85 ± 0.21^{c*}	2.15 ± 0.21^{d}	0.18 ± 0.01^{d}	0.33 ± 0.01^{d}	0.99 ± 0.01^{a}	12.55 ± 0.14^{d}	0.00 ± 0.00^{d}
Sample A	6.35 ± 0.71^{b}	28.50 ± 0.71^{a}	0.20 ± 0.00^{a}	2.83 ± 0.01^{a}	4.87 ± 0.01^{a}	12.75 ± 0.07^{a}	5.85 ± 0.07^{a}	0.77 ± 0.01^{a}	0.53 ± 0.01^{a}	0.19 ± 0.01^{b}	20.05 ± 0.01^{a}	6.80 ± 0.14^{a}
Sample B	6.75 ± 0.71^{a}	27.65 ± 0.21^{c}	0.13 ± 0.00^{c}	1.54 ± 0.01^{c}	2.66 ± 0.02^{c}	7.45 ± 0.07^{c}	4.70 ± 0.14^{c}	0.47 ± 0.01^{c}	0.38 ± 0.01^{c}	0.13 ± 0.01^{c}	13.17 ± 0.01^{c}	5.35 ± 0.07^{b}
Sample C	6.15 ± 0.71^{c}	28.15 ± 0.35^{b}	0.19 ± 0.00^{b}	1.85 ± 0.01^{b}	3.18 ± 0.01^{b}	9.65 ± 0.07^{b}	5.30 ± 0.14^{b}	0.67 ± 0.01^{b}	0.42 ± 0.00^{b}	0.23 ± 0.01^{a}	16.23 ± 0.13^{b}	4.900 ± 0.14^{c}

Table 7: Preliminary Soil Analysis. a, b, c, d=Means with same superscript is not significantly different at P=0.005 level of significance. Control=Uncontaminated soil; Sample A=Cassava mill soil from Amaoba; Sample B=Cassava mill soil from Umuarigha I; Sample C=Cassava mill soil from Umuarigha II; P=Phosphorus; N=Nitrogen; OC=Organic Carbon; OM=Organic Matter; Ca=Calcium; Mg=Magnesium; K=Potassium; Na=Sodium; EA=Exchangeable Acidity; EC=Electrical Conductivity; CN=Cyanide.

The result (Table 7) shows that the soil samples had a significant difference ($p>0.05$) from the control in all soil properties there were analyzed.

The result (Table 8) shows that there was a significant difference ($p>0.05$) from the control in the soil properties that were analyzed.

Treatments	Soil pH	P	N	OC	OM	Ca	Mg	K	Na	EA	EC	CN
Control	4.89 ± 0.02^{d}	15.26 ± 0.64^{d}	0.02 ± 0.01^{d}	0.63 ± 0.03^{d}	1.63 ± 0.02^{c}	5.31 ± 0.01^{c}	1.41 ± 0.01^{d}	0.08 ± 0.00^{d}	0.23 ± 0.01c*	0.62 ± 0.01c*	9.14 ± 0.01^{d}	0.00 ± 0.00^{d}
Sample A	5.85 ± 0.07^{b}	25.85 ± 0.71^{a}	0.14 ± 0.00^{a}	2.68 ± 0.01^{a}	4.62 ± 0.00^{a}	9.75 ± 0.71^{a}	4.25 ± 0.71^{b}	0.58 ± 0.01^{a}	0.38 ± 0.00^{a}	0.75 ± 0.14^{a}	15.60 ± 0.14^{a}	4.70 ± 0.14^{a}
Sample B	5.80 ± 0.14^{c}	23.40 ± 0.71^{c}	0.08 ± 0.00^{c}	0.85 ± 0.01^{c}	1.45 ± 0.00^{d*}	5.25 ± 0.71^{d*}	3.80 ± 0.14^{c}	0.32 ± 0.01^{c}	0.21 ± 0.00^{d*}	0.54 ± 0.46^{d*}	10.48 ± 0.14^{c}	4.20 ± 0.25^{c}
Sample C	5.85 ± 0.71^{a}	24.85 ± 0.71^{b}	0.10 ± 0.00^{b}	1.04 ± 0.01^{b}	1.78 ± 0.00^{b}	6.85 ± 0.71^{b}	4.45 ± 0.71^{a}	0.49 ± 0.14^{b}	0.26 ± 0.01^{b}	0.72 ± 0.00^{b}	12.62 ± 0.78^{b}	4.55 ± 0.35^{b}

Table 8: Post-Soil Analysis. Keywords: a, b, c, d= Means with same superscript is not significantly different at P= 0.005 level of significance; Control=Uncontaminated soil; Sample A=Cassava mill soil from Amaoba; Sample B=Cassava mill soil from Umuarigha I; Sample C=Cassava mill soil from Umuarigha II; P=Phosphorus; N=Nitrogen; OC=Organic Carbon; OM=Organic Matter; Ca=Calcium; Mg=Magnesium; K=Pottasium; Na=Sodium; A=Exchangeable Acidity; EC=Electrical Conductivity; CN=Cyanide.

Discussion

Evaluation of the soil physiochemical properties

The present result obtained from preliminary soil analysis show a pH soil with mean of (6.12 ± 0.61) for the samples which was less acidic to that of the control with mean (5.21 ± 0.13). This indicates that the soil pH of the control is more acidic than that of the samples, there is no doubt this is due to the presence of hydrogen cyanide present in the cassava effluent that has been continuously discharged to the soil. According to Ogboghodo et al. [9], an increase in the soil pH level account for the increase in the nutrient content of the soil. The present result shows that exchangeable base (Na, Ca, Mg and K) and other soil nutrients; organic carbon, phosphorus had an increase value than that of the control, this is predicted to the discharge of cassava effluent which increase the soil pH, microbial population and also microbial activities in the soil which lead to the increase in the soil nutrient content.

The result of the post soil analysis shows that there was a decrease in the soil pH value of both the soil samples and the control which proportionally lead to the decrease in the nutrient content of both the samples and the control. This is credited to the plant uptake of hydrogen cyanide that contributed to the high growth performance of the test crops. Also some physical and natural factors such rainfall, temperature, wind contributed to decrease of the hydrogen cyanide which adversely reduced the soil nutrient content.

Determination of cassava effluent impact

In the present result the soil was observed to have an increase in the nutrient content which was attributed to the discharge of cassava effluent on the soil, similar finding was observed by Ogbohodo et al. [9].

According to Ogbohodo et al. [9] cassava effluent has been found to increase the number of organisms in the soil ecosystem which may be associated with an increase in the soil pH, organic carbon and total nitrogen, cassava effluents contains many nutrients in the order of sodium>potassium>magnesium and iron.

The presence of these entire nutrients was observed in a higher concentration in the soil of the three different samples than that of the control. The high concentration of this nutrient in the soil is attributed to the growth performance of the test crops. The high nutrient content of the cassava effluent reflected in the general growth of both maize and cowpea. Similar findings have been reported by Ogbohodo et al. [9].

Determination of cyanide concentration

On the present result for preliminary soil analysis shows that there is a significant difference in the concentration of hydrogen cyanide of the samples from that of the control, although there was no significant difference in hydrogen cyanide concentration of the three different samples. This may be attributed to some physical and natural factors that might have led to the fermentation of the discharged cassava effluent whereby reducing the concentration of the hydrogen cyanide in the soil.

The post soil analysis shows that there was a decrease in the concentration of the hydrogen cyanide of the three different samples from that of the control which evidently shows that the test crops made use of the hydrogen cyanide for their high growth performance.

Determination of growth rate

The present study made use of two test crops (cowpea and maize). There was an appreciable increase in growth of the crops grown in the soil of the three different samples than that of the control. The growth rate at which the test crops grew was slightly different. The growth rate of cowpea was more rapid than that of the maize. However, there was appreciable increase in the growth of all the parameters measured. The result of this experiment is at variant with the report of Olorunfemi et al. [10] and Ikpe et al. [11] who observed an inhibitory property of cassava processing effluent on growth properties of *Zea mays, Sorghum bicolor* and *Pennisetum americanum*.

According to Islam et al. [12] cowpea was observed to have more tolerant to infertile soils and acidic stress. Walter et al. [13] noted that maize performs best in well drained, well aerated, deep warm loams and silt loams. The higher growth rate of cowpea to that of the maize may be attributed to the high tolerance characteristics of cowpea, although maize grow in various type of soils the slow growth rate to the cowpea may be attributed to the type of soil and aeration of the soil. Cyanide had been found to promote the germination of lettuce, amaranthus and lepidium by metabolizing it to cyanoalanine which is in turn converted to asparagine [14]. This may be a reasonable interpretation of the stimulatory effect the cassava mill effluent had on the crop species used in this study.

References

1. Nwabueze TU, Odunsi FO (2007) Optimization of process conditions for cassava *(Manihot esculentus* Crantz) lafun production. African J Biotechnol 6: 92-99.
2. Oyewole OB, Afolami OA (2001) Quality and preference of different cassava varieties for lafun production. J Food Technol Africa 6: 27-29.
3. Desse G, Taye M (2001) Microbial load and Microflora of cassava (*Manihot esculenta* Crantz) and effects of cassava juice on some food borne pathogens. J Food Technol Afri 6: 21-24.
4. Oyewole OB, Odunfa SA (1988) Microbiological studies on cassava fermentation for lafun production. Food Microbiol 5: 125-133.
5. Chukwuka K, Okechukwu R, Azorji J (2013) Farmer perceptions of cassava bacterial blight disease in Oyo State, south-west, Nigeria. African J Root Tuber Cro 10: 67-74.
6. Kakes P (1990) Properties and functions of the cyanogenic system in higher plants. Euphytica 48: 25-43.
7. Vetter J (2000) Plant cyanogenic glycosides. Toxicon 38: 11-36.
8. Adewoye SO, Fawole OO, Owolabi OD, Omotosho JS (2005) Toxicity of cassava waste water effluents to African catfish: Clarias gariepinus. Ethio J Sci 28: 189-194.
9. Ogboghodo IA, Osenweota IO, Eke SO, Iribhogbe AE (2001) Effect of cassava (*Manihot esculanta* Crantz) mill grating effluent on the textual, chemical and biological properties of surrounding soils. World J Biotechnol 2: 292-301.
10. Olorunfemi DI, Emoefe EO, Okieimen FE (2008) Effects of cassava processing effluent on seedling height, biomass and chlorophyll content of some cereals. Res J Environ Sci 2: 221-227.
11. Ikpe F, Idungafa M, Ogburia M, Ayolagha G (2009) Effect of cassava processing effluent on soil properties, growth and yield of maize in south eastern Nigeria. Nig J Soil Sci.
12. Islam S, Carmen RC, Garner JO (2006) Screening for tolerance of stress temperature during germination of twenty five cowpea (Vigna unguiculata L Walp) cultivars. J Food Agri Environ 4: 189-191.

13. Walter OS, Samuel RA, Earl RL (1975) Modern Corn Production. 2nd edn. A & L Publication, USA.

14. Mayer AM, Poljakoff-Mayber A (1963) The germination of seeds. International Series of Pure and Applied Biology, Pergamon Press, Oxford, London, Paris, New York, p: 236.